INTEGRATED ENVIRONMENTAL MONITORING STATUS REPORT FOR FIRST QUARTER 2000

3058

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

JUNE 2000

U.S. DEPARTMENT OF ENERGY

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AMS	air monitoring station
amsl	above mean sea level
AWWT	Advanced Wastewater Treatment Facility
BRSR	Baseline Remedial Strategy Report
BTV	benchmark toxicity value
DFM	Data Fusion Modeling
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FFCA	Federal Facilities Compliance Agreement
FRL	final remediation level
gpad	gallons per acre per day
gpm	gallons per minute
IEMP	Integrated Environmental Monitoring Plan
lbs	pounds
LCS	leachate collection system
LDS	leak detection system
mg/L	milligrams per liter
M gal	million gallons
mrem	millirem
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OMMP	Operations and Maintenance Master Plan
OSDF	on-site disposal facility
pCi/L	picoCuries per liter
pCi/m^3	picoCuries per cubic meter
PRRS	Paddys Run Road Site
TLD	thermoluminescent dosimeter
WPRAP	Waste Pits Remedial Action Project
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter

Introduction

INTEGRATED ENVIRONMENTAL MONITORING STATUS REPORT FOR FIRST QUARTER 2000

The U.S. Department of Energy (DOE) has prepared this report to meet the quarterly reporting obligation defined in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a) for the Fernald site. The IEMP quarterly status reports document the results of DOE's ongoing assessment of environmental conditions at and near the site as full-scale remediation of the Fernald site proceeds. The primary objectives of the report are to:

- Provide a summary of key environmental data collected to track and assess the effectiveness of site emission controls
- Provide Fernald stakeholders with a timely assessment of off-property impacts associated with implementation and operation of remedial actions at the Fernald site
- Document the performance of the groundwater remedy for the Great Miami Aquifer
- Document the status of natural resource impacts and restoration activities.

The information presented in the quarterly status report is primarily organized in summary data tables and graphics with minimal textual discussion. This reporting format efficiently summarizes the wide range of environmental and operational data collected each quarter. The data tables and graphical data displays are designed to allow readers to compare the data to historical information and applicable regulatory standards. The information summarized in the quarterly status reports is presented in greater detail in Fernald's annual integrated site environmental report submitted June 1 of each year. The next IEMP quarterly status report will be submitted in September of 2000.

Groundwater Remedy

1.0 GROUNDWATER REMEDY

This section summarizes the first quarter 2000 operational data for the aquifer remedy and the results of pre-design monitoring conducted in the waste storage and Plant 6 areas. The fourth quarter 1999 analytical data from groundwater monitoring, including project-specific on-site disposal facility data, were reported in the 1999 Integrated Site Environmental Report (DOE 2000a) issued June 1, 2000, and are therefore not included in this report. The material in this section satisfies the groundwater reporting requirements presented in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a).

Figure 1-1 shows the sampling activities that contributed data to this section. Figure 1-2 identifies the IEMP groundwater extraction and monitoring wells by module/monitoring activity and Figure 1-3 shows the IEMP water level (groundwater elevation) monitoring wells. Figure 1-4 shows the location of the active aquifer restoration modules and extraction/re-injection wells.

Figure 1-1 also shows the groundwater monitoring activities to be summarized in the next IEMP quarterly status report to be submitted in September of 2000. The report will contain operational data and the plume capture assessment from April through June 2000 (second quarter) and analytical results from the groundwater sampling activities conducted from January through March 2000 (first quarter).

1.1 OPERATIONAL ASSESSMENT

1.1.1 AQUIFER RESTORATION SYSTEM SUMMARY

Table 1-1 summarizes the operational data from the three active restoration modules for the first quarter of 2000. The South Plume and South Field (Phase I) Extraction Modules pumped a total of 482.993 million gallons of groundwater and removed 220.68 pounds of uranium during this reporting period. The Re-Injection Demonstration Module re-injected 127.961 million gallons of treated groundwater back into the aquifer for a net total extraction of 355.032 million gallons. To date, 5.432 billion gallons of groundwater have been pumped and 1,728.05 pounds of uranium have been removed from the aquifer. During the first quarter of 2000, re-injection returned 3.59 pounds of uranium back into the aquifer. Figure 1-5 depicts the total groundwater pumped versus groundwater treated during the first quarter of 2000. Figure 1-6 shows the uranium removal indices for the South Field (Phase I) Extraction and South Plume Modules.

1.1.2 MODULE-SPECIFIC SUMMARIES

1.1.2.1 SOUTH FIELD (PHASE I) EXTRACTION MODULE

As indicated in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1999 (DOE 2000b), two new extraction wells (32446 and 32447) began pumping in February 2000. Figure 1-4 shows these wells. Each new extraction well's target pumping rate was 200 gallons per minute (gpm). The first quarter increase in the uranium removal index for this module is attributable to the start-up of the new wells. The module target pumping rate for the combined nine original and two additional active extraction wells was 1,900 gpm. For the majority of the period, all active extraction wells in the module were pumped at or above the rates specified in the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) (DOE 1997).

To help compensate for well downtimes (due to maintenance, electrical outages, etc.), pumping rates of nine of the 10 original extraction wells (not including Extraction Well 31566) were increased by 10 percent in the latter portions of both February and March. The opportunity to increase the pumping rates was made available by higher than average groundwater treatment capacity and lower than normal uranium concentrations in the site effluent (concentrations measured at the Parshall Flume [PF 4001] – refer to the Surface Water Section) to the Great Miami River. The pumping rate increases may continue in the latter portions of future months depending on the available treatment capacity and uranium concentrations in site effluent.

Table 1-2 provides operational details for this module. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-2 and selecting the appropriate well number. Figure 1-18 provides the weekly total uranium concentrations for each extraction well in this module.

1.1.2.2 SOUTH PLUME MODULE

The South Plume Module target pumping rate was 2,000 gpm. For the majority of the period, the six wells (Figure 1-4) were pumped at or above the rates specified in the Baseline Remedial Strategy Report. The monthly average pumping rate for Extraction Well 3926 was significantly lower in January than in February or March because the well underwent rehabilitation activities at the beginning of the month. To help compensate for well downtimes (due to maintenance, electrical outages, etc.), pumping rates of Extraction Wells 32308 and 32309 were increased by 20 percent in the latter portions of both February and March. The opportunity to increase the pumping rates was made available by higher than average groundwater treatment capacity and lower than normal uranium concentrations in the site effluent (concentrations measured at the Parshall Flume [PF 4001] – refer to the Surface Water Section). The pumping rate increases may continue in the latter portions of future months depending on the available treatment capacity and uranium concentrations in site effluent.

Table 1-3 provides operational details for the South Plume Module. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-3 and selecting the appropriate well number. Figure 1-25 depicts the weekly total uranium concentrations for each well in this module.

1.2 AQUIFER CONDITIONS

1.2.1 URANIUM PLUME

1.2.1.1 TOTAL URANIUM PLUME

The most current sitewide uranium plume map (corresponding to fourth quarter 1999) was provided in the 1999 Integrated Site Environmental Report which was submitted to the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) on June 1, 2000 (Figure A.2-5). Although no sitewide uranium plume map for the first quarter is provided in this report, Figure 1-32 provides new information on the uranium plumes in the waste storage and Plant 6 areas.

As identified in the 1999 Integrated Site Environmental Report, early in 2000, additional characterization efforts utilizing 30 direct-push sampling locations were conducted in the waste pit and Plant 6 areas to support the engineering design of the aquifer restoration modules planned for these areas. Additionally, some wells in these areas, which are not part of the IEMP, were sampled to support the characterization efforts.

Waste Storage Area Plume

Prior to this characterization effort, uranium contamination in the waste storage area was interpreted as a single large uranium plume (set forth in Plate E-81 of the Remedial Investigation Report for Operable Unit 5 [DOE 1995]). As a result of the recent data, this interpretation has been refined to depict three individual plumes. One plume is a relatively narrow east-west trending plume that parallels and extends east of the Pilot Plant Drainage Ditch, with uranium concentrations up to 566 μg/L. The second plume is in the vicinity of the silos and the Bio-Surge Lagoon, with uranium concentrations up to 31 μg/L. This plume has not been fully defined due to the inability to sample beneath these areas. The third and final plume is east of Waste Pit 3 and the clearwell area with uranium concentrations up to 30 μg/L.

Uranium concentration data from the following locations were used to make the new conclusions identified in Figure 1-32:

- Twenty-seven direct-push locations (12614 through 12619, 12684, 12686, and 12707 through 12725) sampled from November 1999 through May 2000
- Ten wells (2010, 2020, 2037, 2052, 2108, 2454, 2936, 3020, 3037, and 3108) sampled in January and February 2000 to support the characterization efforts (supplemental monitoring results)
- IEMP locations in the waste storage area sampled in December 1999 as part of routine IEMP sampling efforts
- Five wells (not sampled as part of the IEMP – 2004, 2028, 3004, 2949, and 2951) that were either abandoned or could not be accessed due to surface excavation activities (sampled prior to 2000).

1.1.2.3 RE-INJECTION DEMONSTRATION MODULE

The target re-injection rate for this module was 1,000 gpm. Groundwater was re-injected through the five wells (Figure 1-4) near the rates specified in the Baseline Remedial Strategy Report for the majority of the period. Re-injection Wells 22107 and 22108 were operating at less than the target pumping rate in January due to shutdowns for well rehabilitation activities. To help compensate for well downtimes (due to maintenance, electrical outages, etc.), re-injection rates of all five wells were increased by 10 percent in the latter portions of both February and March. The opportunity to increase the re-injection rates was made available by higher than average groundwater treatment capacity and lower than normal uranium concentrations in the site effluent (concentrations measured at the Parshall Flume [PF 4001] – refer to the Surface Water Section). The re-injection rate increases may continue in the latter portions of future months depending on the available treatment capacity and uranium concentrations in site effluent.

The total uranium concentration trended upward in the injectate source water during the first quarter of 2000 (Figure 1-31). At the close of the quarter, the injectate total uranium concentration was about 6 micrograms per liter (µg/L), well below the administrative action level of 10 µg/L. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-4 and selecting the appropriate well number.

In addition to the three plumes, Figure 1-32 identifies the unusually high total uranium concentration in Monitoring Well 3027. As identified in the 1999 Integrated Site Environmental Report, efforts were made to determine the source of these concentrations. These efforts included a camera survey of the well to determine if perched water was leaking into the well; removing the dedicated pump and cleaning it; pumping the well to remove accumulated sediment; and collecting samples with varying turbidity and analyzing them for total uranium. Results of the camera survey indicated that the well was not leaking at the time of the survey. Additional, short-term pumping of this well is being planned to see if uranium concentrations can be readily brought back down below the 20 µg/L total uranium final remediation level (FRL).

Plant 6 Area Plume

The Plant 6 area uranium plume portrayed in the 1999 Integrated Site Environmental Report no longer appears to be present at concentrations greater than the 20 µg/L FRL. This conclusion is based on uranium concentration data from:

- Three direct-push locations (12651, 12652, and 12653) sampled in late December through January 2000
- One well (2109) sampled in January 2000 to support the characterization efforts (supplemental monitoring result)
- IEMP wells in the Plant 6 area sampled in December 1999 as part of routine IEMP sampling efforts (2054, 2118, 2389, and 3054)
- One well (2120) that was sampled prior to being plugged and abandoned in 1996.

Refer to Figure 1-32 for the previous plume configuration and sample locations.

As the results of the pre-design sampling were obtained, they were discussed with EPA and OEPA during the weekly site update teleconferences. A conceptual design for the Waste Storage Area Aquifer Restoration Module is being prepared based on the pre-design characterization efforts. The conceptual design will be reviewed in a to-be-scheduled meeting with EPA and OEPA to solicit their input. EPA and OEPA input will be factored into the preliminary designs for the Waste Storage Area and Plant 6 Area Modules, which are scheduled to be submitted in June and August 2001, respectively.

1.2.1.2 RE-INJECTION DEMONSTRATION CROSS-SECTIONS

This section will be removed from the Internet site in the future because re-injection cross-sections will only be provided annually.

1.2.2 GROUNDWATER ELEVATIONS AND CAPTURE ASSESSMENT

1.2.2.1 GROUNDWATER ELEVATIONS AND CAPTURE ASSESSMENT

Groundwater elevation measurements for the first quarter of 2000 were collected from January 17 through January 19, 2000. The Type 2 measurements are contoured in Figure 1-33. The figure also contains some Type 6 measurements (Type 6 wells are screened at a slightly deeper interval than Type 2 wells), which are posted to achieve better lateral coverage across the map area. Actual pumping rates for each module from January 17 through January 19 are posted on the figure to document the pumping conditions on these dates.

Past experience at the Fernald site has shown that with a large number of wells (approximately 180) being measured each quarter, some measurement, transcription, or data entry errors occur (typically less than five percent). These errors often become apparent when the data are posted to maps and the contouring process begins. When the errors are identified, the erroneous data points are removed from the data set to be contoured in order to produce a water level map that represents aquifer conditions. Two measurements were not used in the January contour data set: the water level measurements from Monitoring Wells 2898 and 2091. Monitoring Well 2898 is located in the South Plume area. Monitoring Well 2091 is located east of the Fernald site along State Route 128. The measurement at Monitoring Well 2898 was removed because the elevation recorded (507.28 feet above mean sea level [amsl]) is approximately 3.5 feet lower than the average elevation of surrounding wells (approximately 510 feet amsl). The measurement at Monitoring Well 2091 was removed because the elevation recorded (515.11 feet amsl) is approximately two feet higher than the average elevation of the surrounding wells (approximately 513 feet amsl).

Capture of the main portion of the South Plume (north of Paddys Run Road Site [PRRS] above the 20 µg/L total uranium FRL) continued during the first quarter of 2000 due to pumping of the South Plume Module (refer to Figure 1-34), with the exception of the extreme southwest tip of the plume near Monitoring Well 2552. This portion of the plume was extended slightly to the southwest based on the fourth quarter 1999 uranium concentration at Monitoring Well 2552. This fluctuation in uranium concentration at Monitoring Well 2552 has been observed in the past. In the past, it has been reported that Monitoring Well 2552 is sometimes within the capture zone of the recovery system and sometimes outside of the capture zone as water levels in the aquifer fluctuate from seasonal drawdown and recharge.

Figure 1-34 shows the predicted steady state groundwater elevations based on the groundwater model with the South Field (Phase I) Extraction, Re-Injection Demonstration, and South Plume Modules operating as specified in the Baseline Remedial Strategy Report. For comparative purposes, the 10-year, uranium-based restoration footprint (capture zone), the maximum total uranium plume outline (updated with fourth quarter 1999 data), and the interpreted capture zones from the groundwater elevation map (Figure 1-33) are also shown on the figure. Note that the modeled capture zone and the capture zone derived from the January water level measurements appear to be in good agreement.

1.2.2.2 SOUTH PLUME ADMINISTRATIVE BOUNDARY

The most recent data (fourth quarter 1999) were reported through the 1999 Integrated Site Environmental Report submitted to EPA and OEPA on June 1, 2000.

1.2.2.3 GROUNDWATER MODEL

The groundwater flow model has been successfully recalibrated to an October 1998 groundwater elevation data set and has been validated against three other quarterly elevation data sets (April 1998, June 1999, and October 1999). The re-calibration effort has been completed and the results are in the Great Miami Aquifer VAM3D Flow Model Re-calibration Report (DOE 2000d) which was submitted to EPA and OEPA in May 2000.

Phase II of the groundwater model upgrade project, which incorporates data fusion technology into the groundwater transport model has been completed. The information on this effort are provided in the Integration of Data Fusion Modeling (DFM) with VAM3DF Contaminant Transport Code Report (DOE 2000c) which was received from HydroGeoLogic, Inc. in April, and provided to EPA and OEPA in May 2000. Data fusion, when coupled with the contaminant transport code, provides a mechanism to allow the model to set transport parameters within pre-determined ranges to best match observed field data, thereby improving model predictions. Model output from data fusion also provides a quantitative measure of model uncertainty.

The U.S. Department of Energy (DOE) is planning an evaluation and application phase for the data fusion modeling (DFM) code, which will begin during the summer of 2000. The DFM code will not be used for decisions affecting the performance or design of the aquifer remedy until the evaluation and application activity has been completed and reviewed by EPA and OEPA.

Phase III of the groundwater model upgrade project, which consists of an optimization package, will not be started until this evaluation and application activity has been completed. When completed, it is anticipated that Phase III of the model upgrade will provide a decision support system to optimize extraction/re-injection well locations and pumping rates for the aquifer remedy.

1.2.3 KC-2 WAREHOUSE WELL MONITORING

As reported in the 1999 Integrated Site Environmental Report and as identified in DOE Letter No. 0087-00, dated November 1, 1999, which transmitted changes to the IEMP to EPA and OEPA, the KC-2 Warehouse Well (Well 67) has been removed from the IEMP sampling program. Well 67 has been removed because, as planned, it was plugged and abandoned on April 13, 2000. Prior to plugging and abandonment, the well was sampled in March of 2000. This data will be reported in the next IEMP quarterly status report.

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TABLE 1-1

AQUIFER RESTORATION SYSTEM OPERATIONAL SUMMARY SHEET

	Reporting Period					
	January 2000 through March 2000			August 1993 through March 2000		
	Gallons Pumped/Re-Injected (M gal)	Total Uranium Removed/Re-Injected (lbs)	Uranium Removal Index[a] (lbs/M gal)	Gallons Pumped/Re-injected (M gal)	Total Uranium Removed/Re-Injected (lbs)	Uranium Removal Index[a] (lbs/M gal)
South Field (Phase I) Extraction Module	226.301	151.79	0.67	1,333.200	855.67	0.64
South Plume Module	256.692	68.89	0.27	4,786.816	902.61	0.19
Re-Injection Demonstration Module	127.961	3.59	NA	687.679	30.23	NA
Aquifer Restoration Systems Totals						
(Extraction Wells)	482.993	220.68	0.46	6,120.016	1,758.28	0.29
(Re-Injection Wells)	127.961	3.59	NA	687.679	30.23	NA
(net)	355.032	217.09	NA	5,432.337	1,728.05	NA

[a]NA = not applicable

TABLE 1-2

SOUTH FIELD (PHASE I) EXTRACTION MODULE OPERATIONAL SUMMARY SHEET FOR FIRST QUARTER (JANUARY 2000 THROUGH MARCH 2000)

Extraction Well	31565	31564	31563	31567	31550	31560	31561	31562	32276	32447[a]	32446[a]
	Baseline Remedial Strategy Report Target Pumping Rates (gpm)										
	200	200	200	100	100	100	100	100	200	200	200
	Average Pumping Rates (gpm)										
January	202	202	201	128	101	101	102	201	302	-	-
February	210	209	216	152	105	105	106	211	316	41	41
March	196	195	201	105	105	105	105	209	313	198	199
Quarterly Average	203	202	206	128	104	104	104	207	310	120[b]	120[b]
	Average Total Uranium Concentrations (µg/L)										
January	11.8	14.5	25.2	34.6	57.0	90.0	39.9	100.1	163.2	NA	NA
February	11.2	14.4	25.1	35.7	56.0	89.9	43.1	103.9	160.9	302.3	166.8
March	11.2	14.2	25.4	36.5	56.4	87.2	42.7	105.0	154.9	266.9	137.2
Quarterly Average	11.4	14.4	25.2	35.6	56.5	89.1	41.9	103.0	159.6	284.6	152.0
	Uranium Removal Index (Pounds of Total Uranium Removed/Million Gallons Pumped)										
January	0.10	0.12	0.21	0.29	0.48	0.75	0.33	0.83	1.36	NA	NA
February	0.09	0.12	0.21	0.30	0.47	0.75	0.36	0.87	1.34	2.52	1.39
March	0.09	0.12	0.21	0.30	0.47	0.73	0.36	0.88	1.29	2.23	1.14
Quarterly Average	0.09	0.12	0.21	0.30	0.47	0.74	0.35	0.86	1.33	2.38	1.27

	Average Module Pumping Rate (gpm)	Water Pumped by Module (M gal)	Total Uranium Concentration from Module[c] (µg/L)
January	1,540	68.880	67.0
February	1,705	71.195	75.1
March	1,935	86.226	95.4
Quarterly Average	1,727	Total 226.301	Quarterly Average 79.17

[a]NA = not applicable
[b]These wells did not begin operation until February 24, 2000.
[c]Average is calculated from individual well total uranium concentrations and flow rates.

TABLE 1-3

**SOUTH PLUME MODULE
OPERATIONAL SUMMARY SHEET FOR FIRST QUARTER
(JANUARY 2000 THROUGH MARCH 2000)**

Extraction Well	3924	3925	3926	3927	32308	32309
	Baseline Remedial Strategy Report Target Pumping Rates (gpm)					
	300	300	400	400	250	250
	Average Pumping Rates (gpm)					
January	300	293	314	486	249	249
February	300	293	379	479	274	273
March	300	292	378	474	271	271
Quarterly Average	300	293	357	480	265	264
	Average Total Uranium Concentrations (µg/L)					
January	36.5	26.9	19.7	2.0	67.0	71.0
February	38.6	28.5	25.5	1.9	69.3	69.1
March	35.8	32.7	23.4	2.0	70.0	65.5
Quarterly Average	37.0	29.4	22.9	2.0	68.8	68.5
	Uranium Removal Index (Pounds of Total Uranium Removed/Million Gallons Pumped)					
January	0.30	0.22	0.16	0.02	0.56	0.59
February	0.32	0.24	0.21	0.02	0.58	0.58
March	0.30	0.27	0.20	0.02	0.58	0.55
Quarterly Average	0.31	0.24	0.19	0.02	0.57	0.57

	Average Module Pumping Rate (gpm)	Water Pumped by Module (M gal)	Total Uranium Concentration from Module[a] (µg/L)
January	1,890	84.378	31.9
February	1,999	83.467	34.2
March	1,990	88.847	30.5
Quarterly Average	1,960	Total 256.692	Quarterly Average 32.2

[a]Average is calculated from individual well total uranium concentrations and flow rates.

TABLE 1-4

RE-INJECTION DEMONSTRATION MODULE
OPERATIONAL SUMMARY SHEET FOR FIRST QUARTER
(JANUARY 2000 THROUGH MARCH 2000)

Re-Injection Well	22107	22108	22109	22240	22111
	Baseline Remedial Strategy Report Target Re-Injection Rates (gpm)				
	200	200	200	200	200
	Average Re-Injection Rates (gpm)				
January	174	137	195	198	198
February	212	210	158	210	210
March	206	206	204	206	206
Quarterly Average	197	184	186	205	205

	Average Module Re-Injection Rate (gpm)	Water Re-Injected By Module (M gal)	Total Uranium Concentration from Module (µg/L)
January	901	40.279	1.7
February	1,000	41.754	3.1
March	1,028	45.928	5.1
Quarterly Average	976	Total 127.961	Quarterly Average 3.3

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FIGURE 1-1

GROUNDWATER SAMPLING ACTIVITIES

SAMPLING ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
South Plume Module:												
Operational	◆	◆	◆	☒	☒	☒						
Aquifer Conditions		☒										
South Field Extraction Module:												
Operational (Phase 1)	◆	◆	◆	☒	☒	☒						
Aquifer Conditions			☒									
Re-Injection Demonstration Module[a]												
Operational	◆	◆	◆	☒	☒	☒						
Waste Storage Area Module:												
Pre-Design Monitoring	◆	◆	◆	◆	◆							
Aquifer Conditions												
Plant 6 Area Module:												
Pre-Design Monitoring	◆											
Aquifer Conditions												
Routine Water-Level/Flow Direction Monitoring	◆			☒								
Property Boundary Monitoring	☒											
Private Well Monitoring	☒											
KC-2 Warehouse Well Monitoring[b]	☒											

● Data summarized/evaluated in this report
☒ Data summarized/evaluated in the next report

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[a]Aquifer conditions for this module are being addressed in the Re-Injection Demonstration Report.
[b]This activity well be discontinued in 2000 due to dismantling of the KC-2 Warehouse and subsequent plugging and abandonment of the KC-2 Warehouse well.

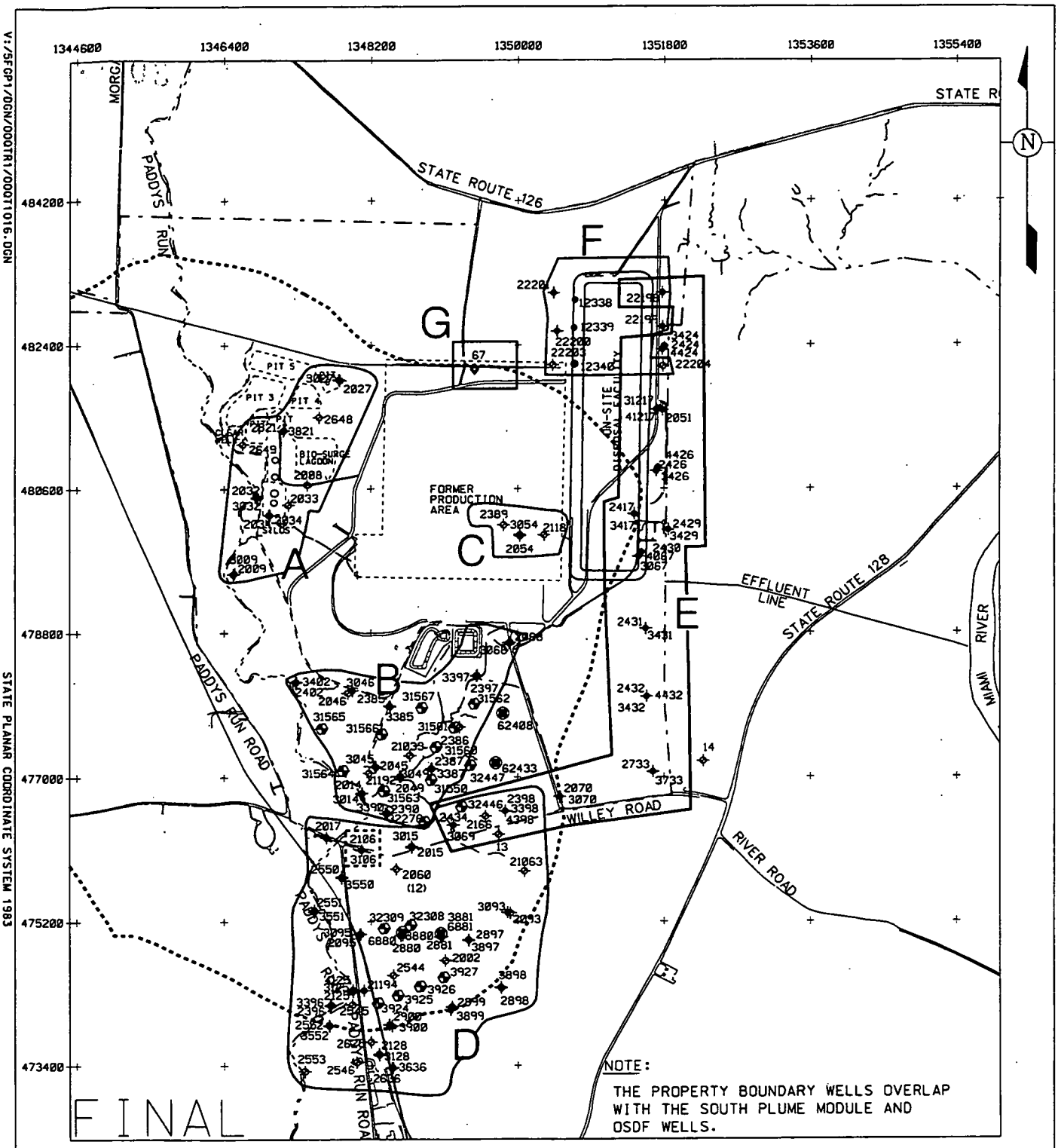

FIGURE 1-2. IEMP WATER QUALITY MONITORING WELLS AND EXTRACTION WELLS

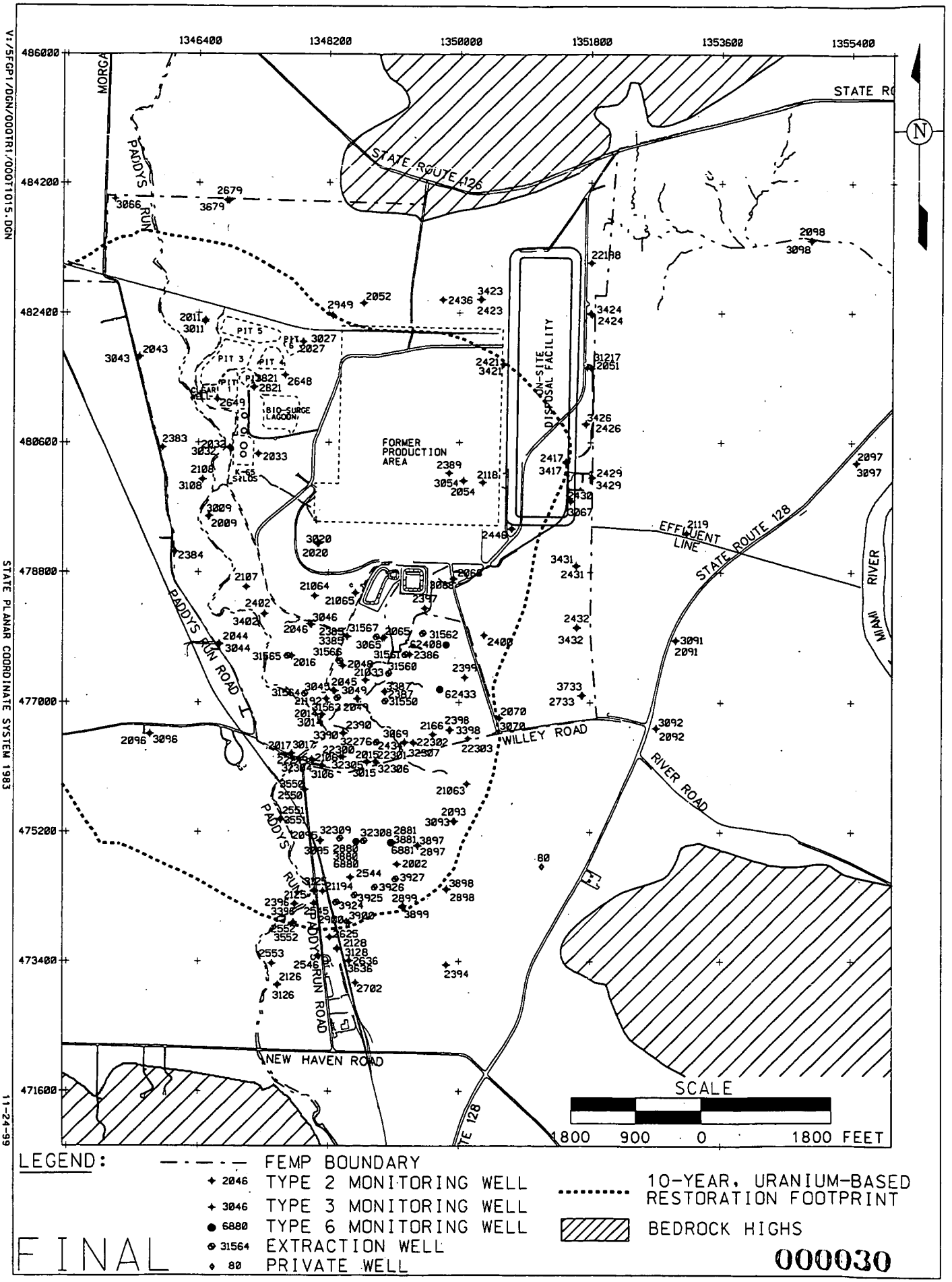

FIGURE 1-3. GROUNDWATER ELEVATION MONITORING WELLS

V:/5EGP1/DGN/0001R1/0001T1001.DGN

STATE PLANAR COORDINATE SYSTEM 1983

11-24-99

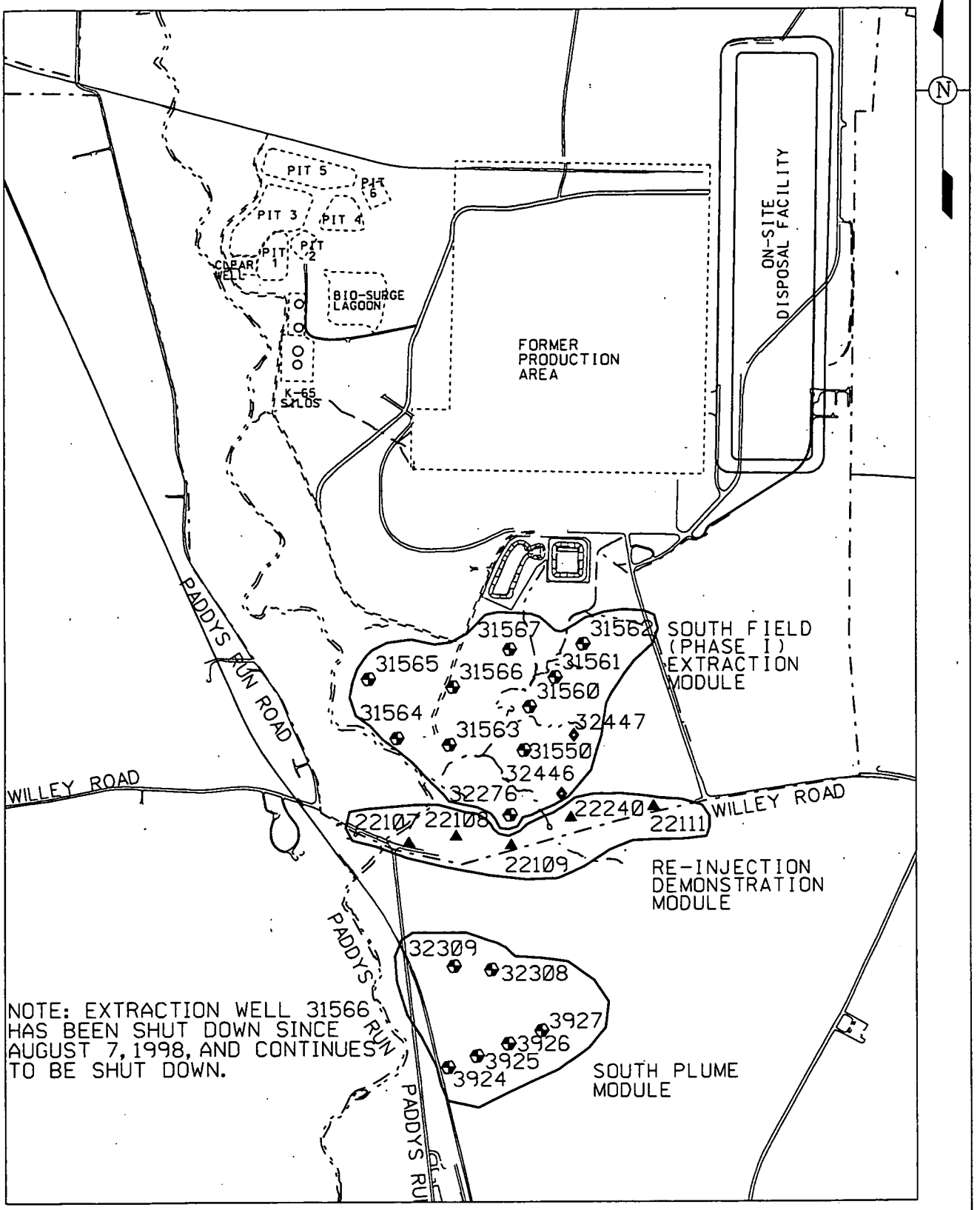

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FIGURE 1-4. LOCATION OF ACTIVE AQUIFER RESTORATION MODULES

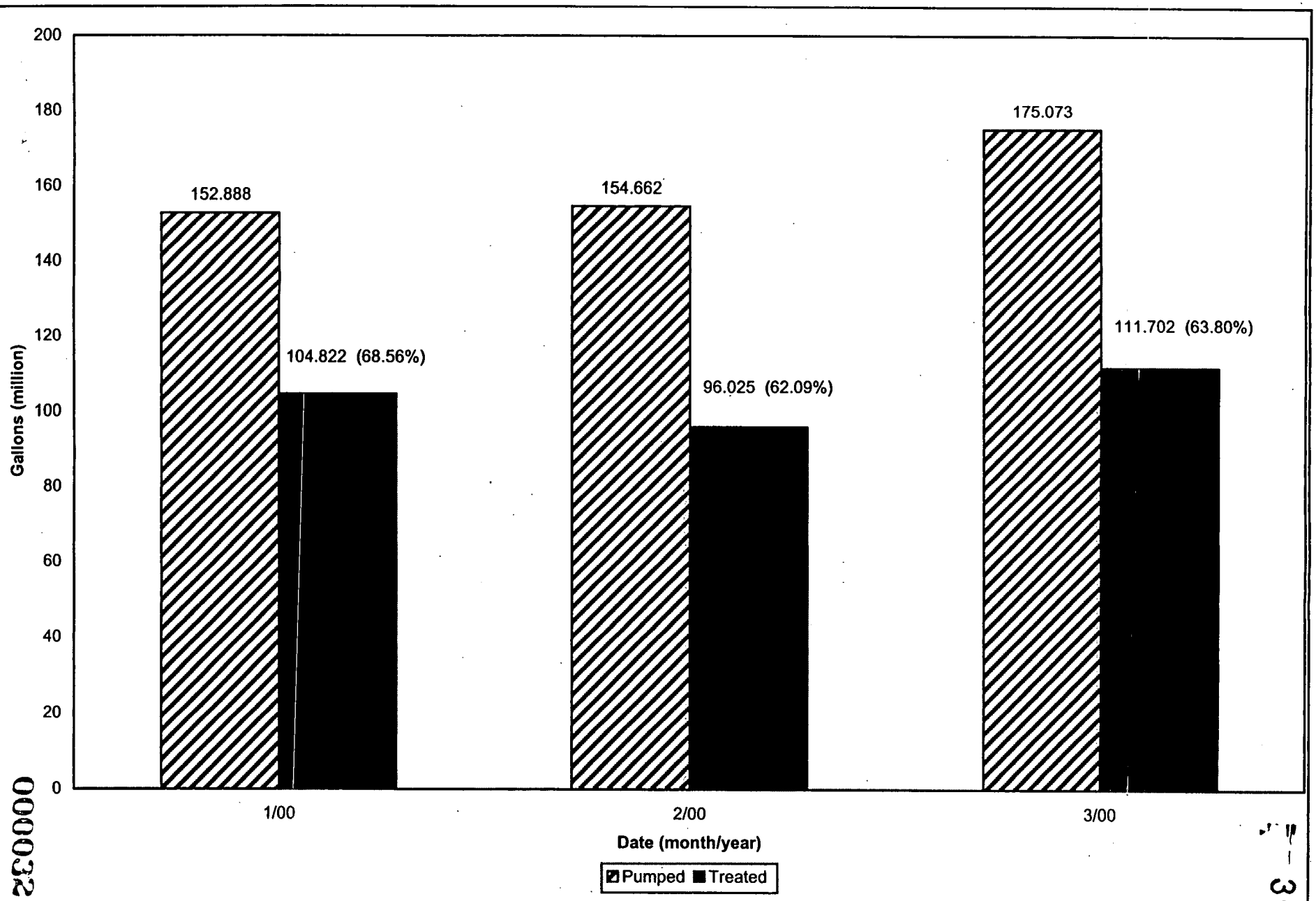

FIGURE 1-5. TOTAL GROUNDWATER PUMPED VS. GROUNDWATER TREATED FOR FIRST QUARTER 2000

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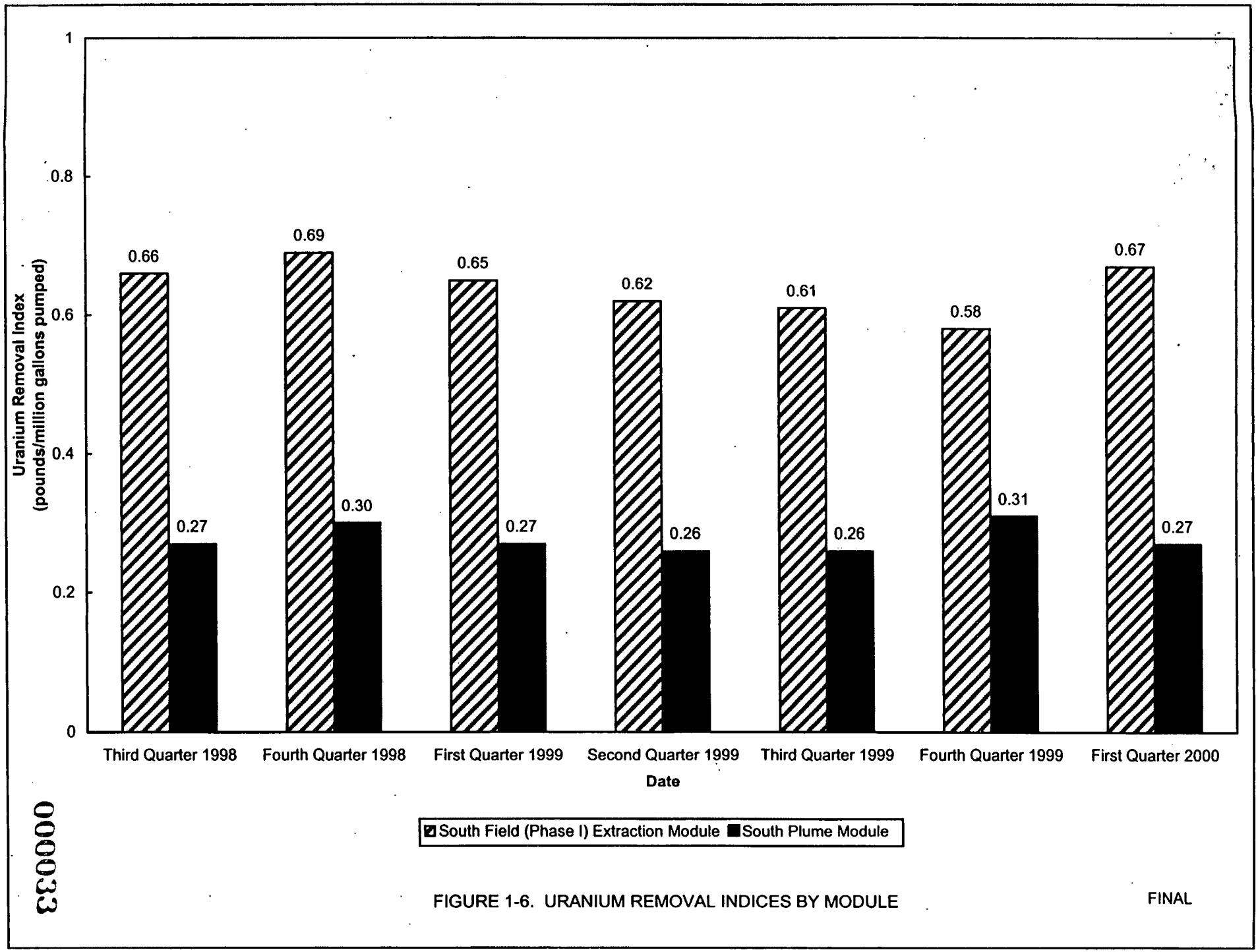

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FIGURE 1-6. URANIUM REMOVAL INDICES BY MODULE

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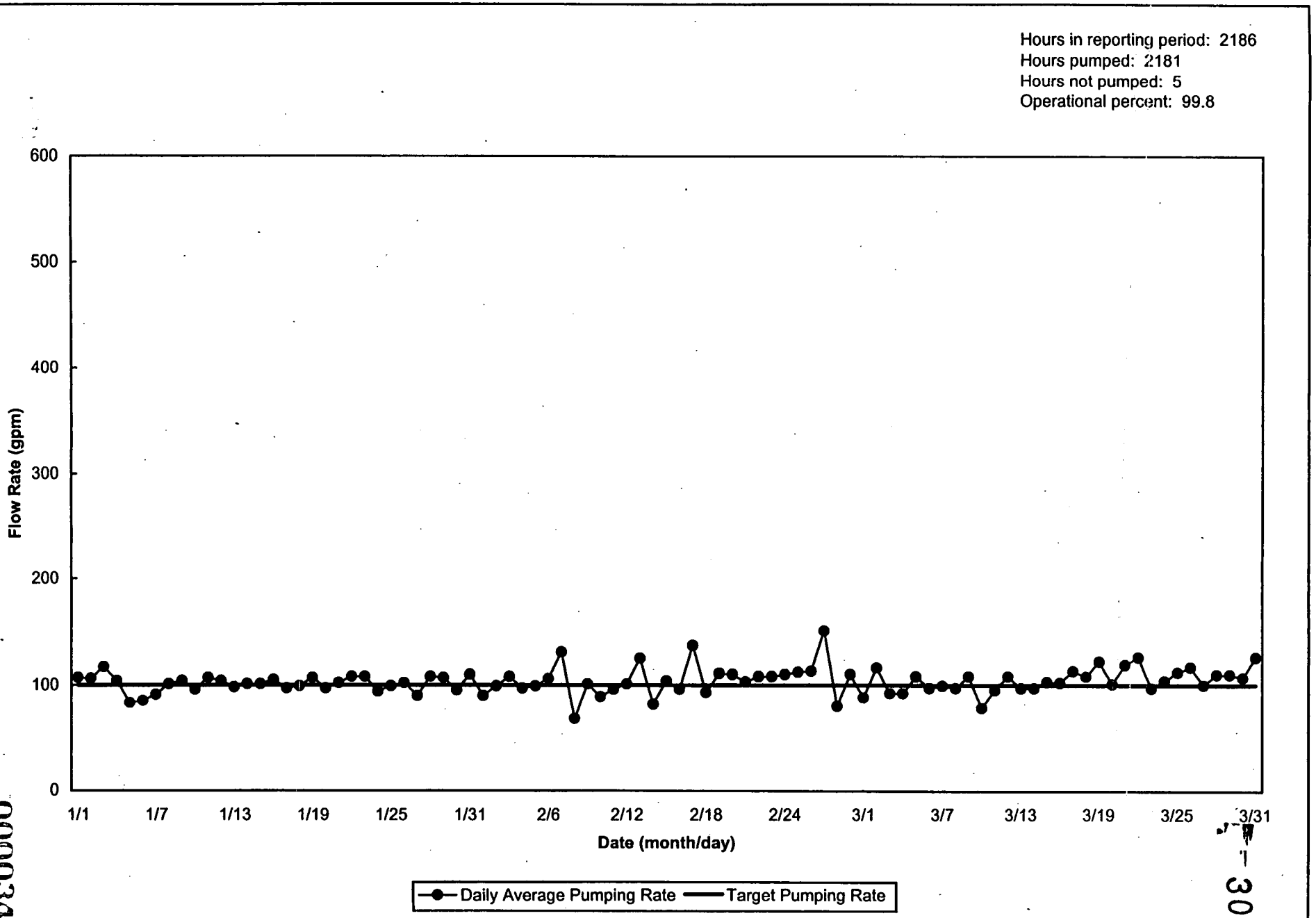
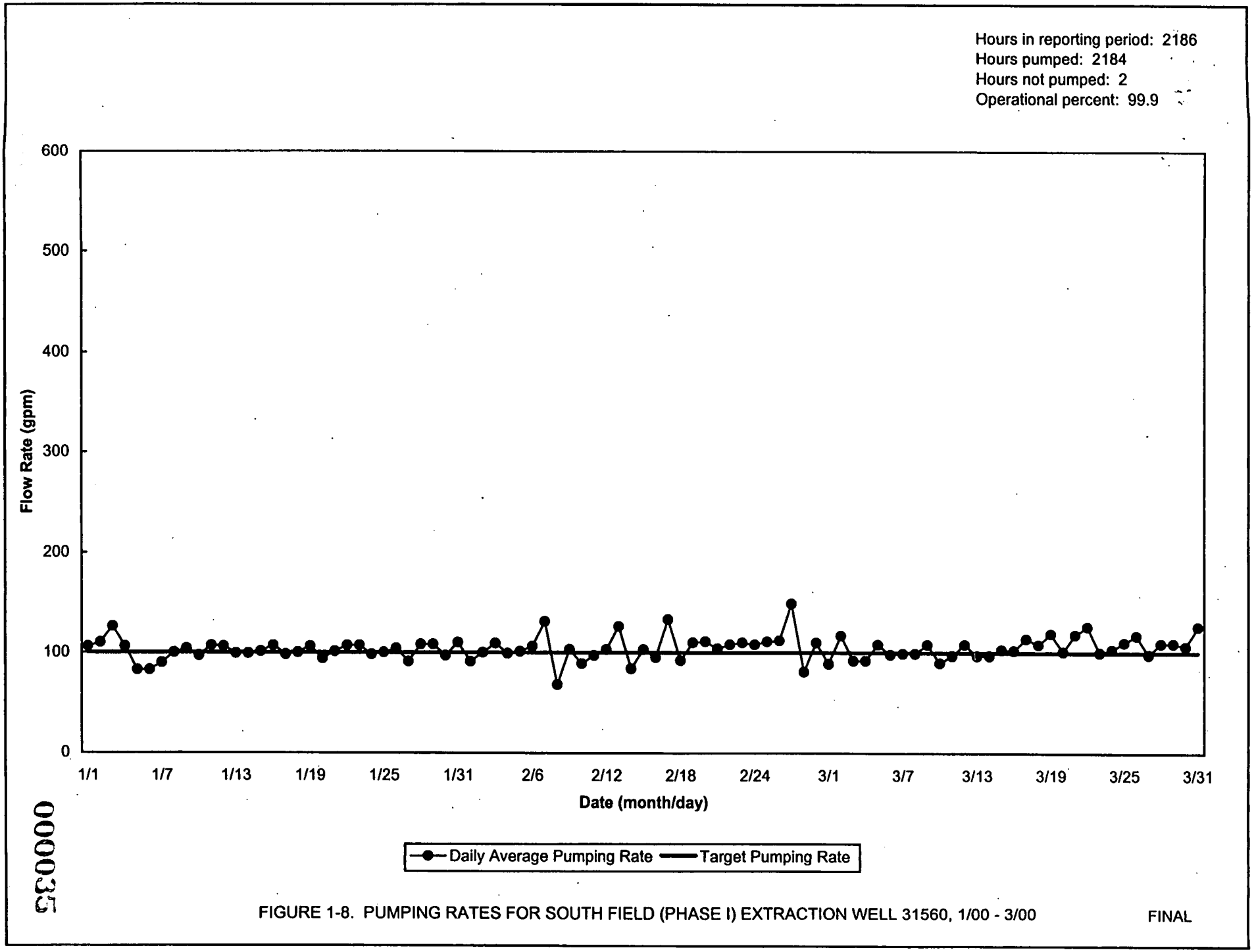


FIGURE 1-7. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31550, 1/00 - 3/00



000033

FIGURE 1-8. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31560, 1/00 - 3/00

FINAL

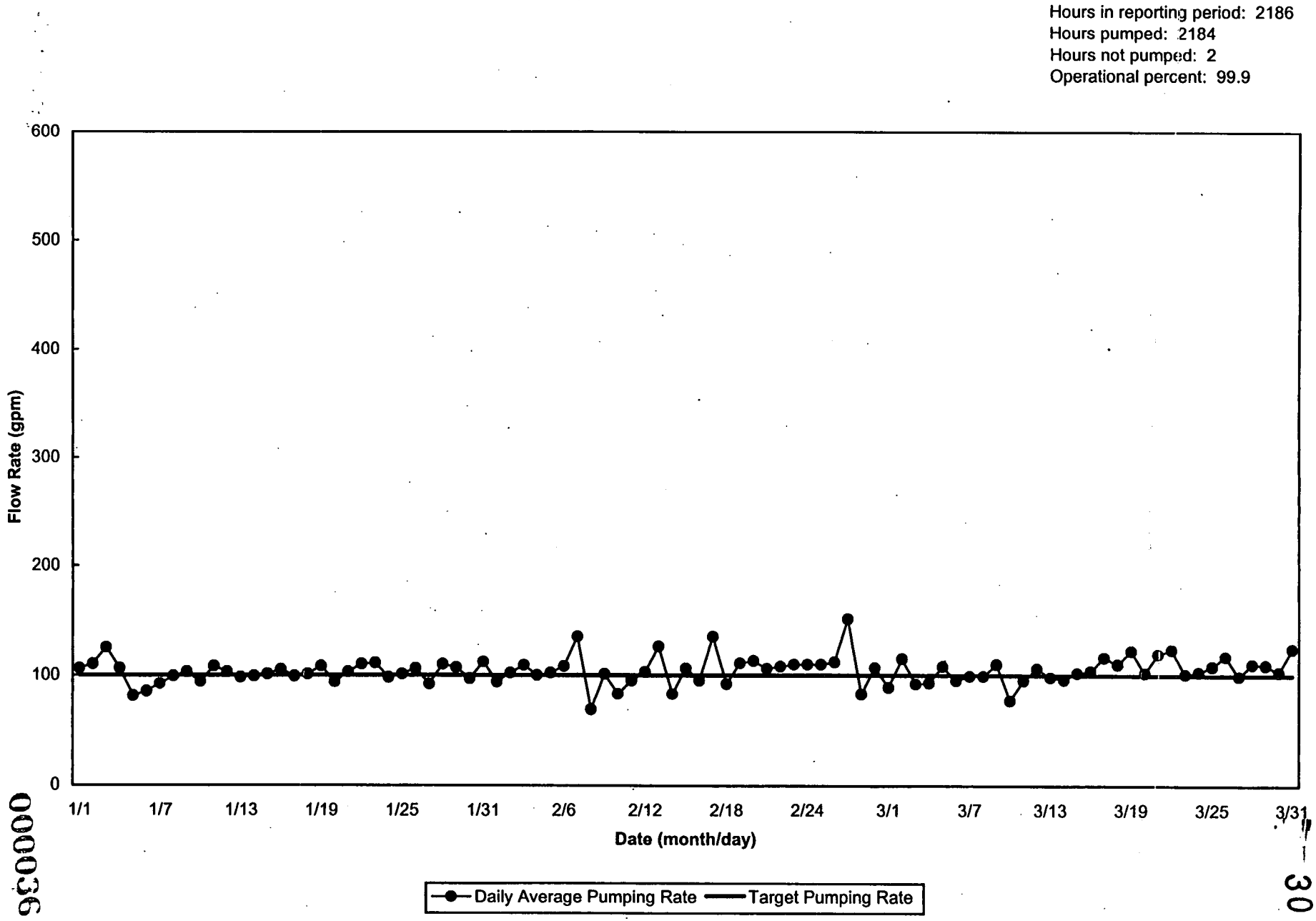
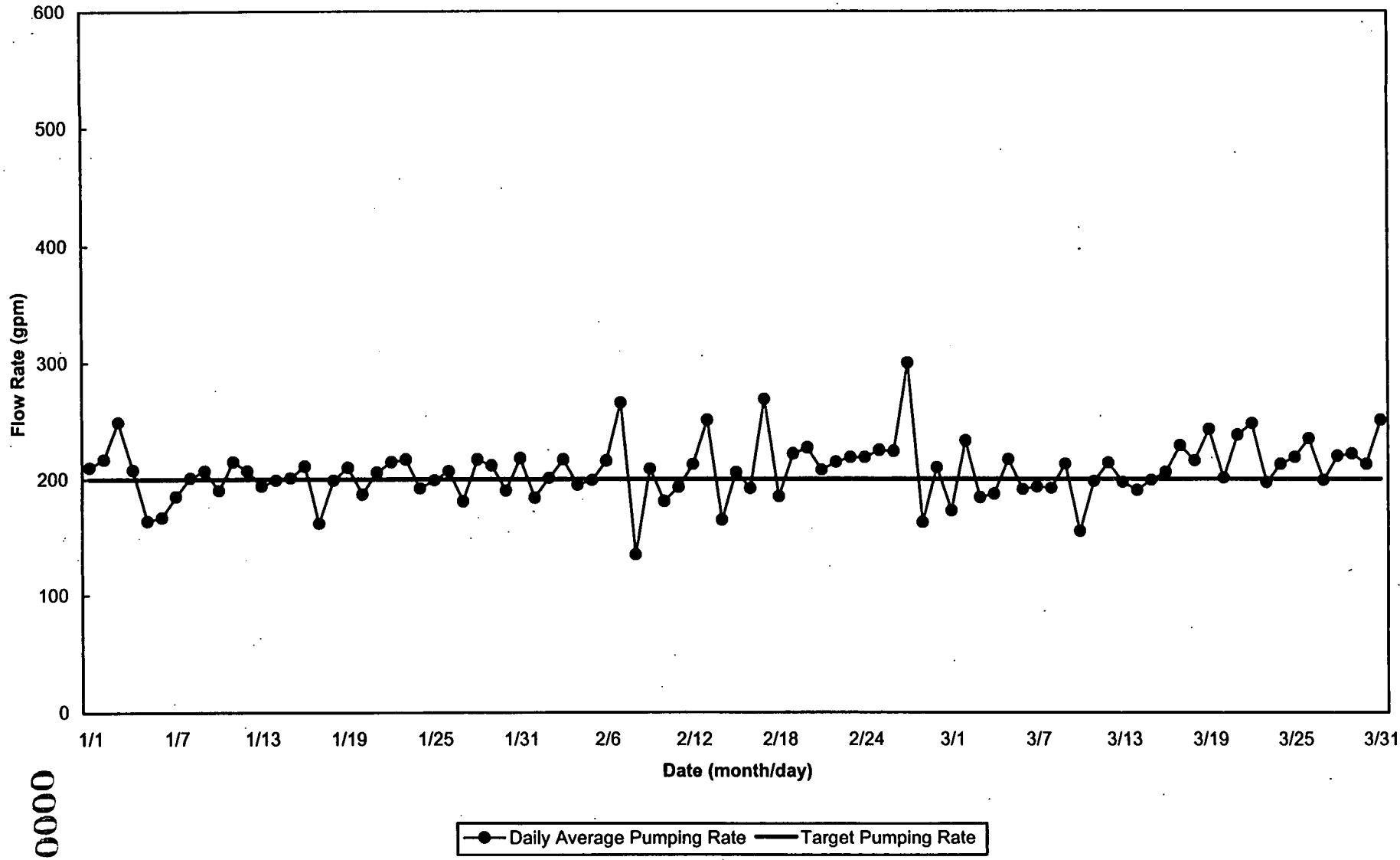


FIGURE 1-9. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31561, 1/00 - 3/00

FINAL



000037

FIGURE 1-10. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31562, 1/00 - 3/00

FINAL

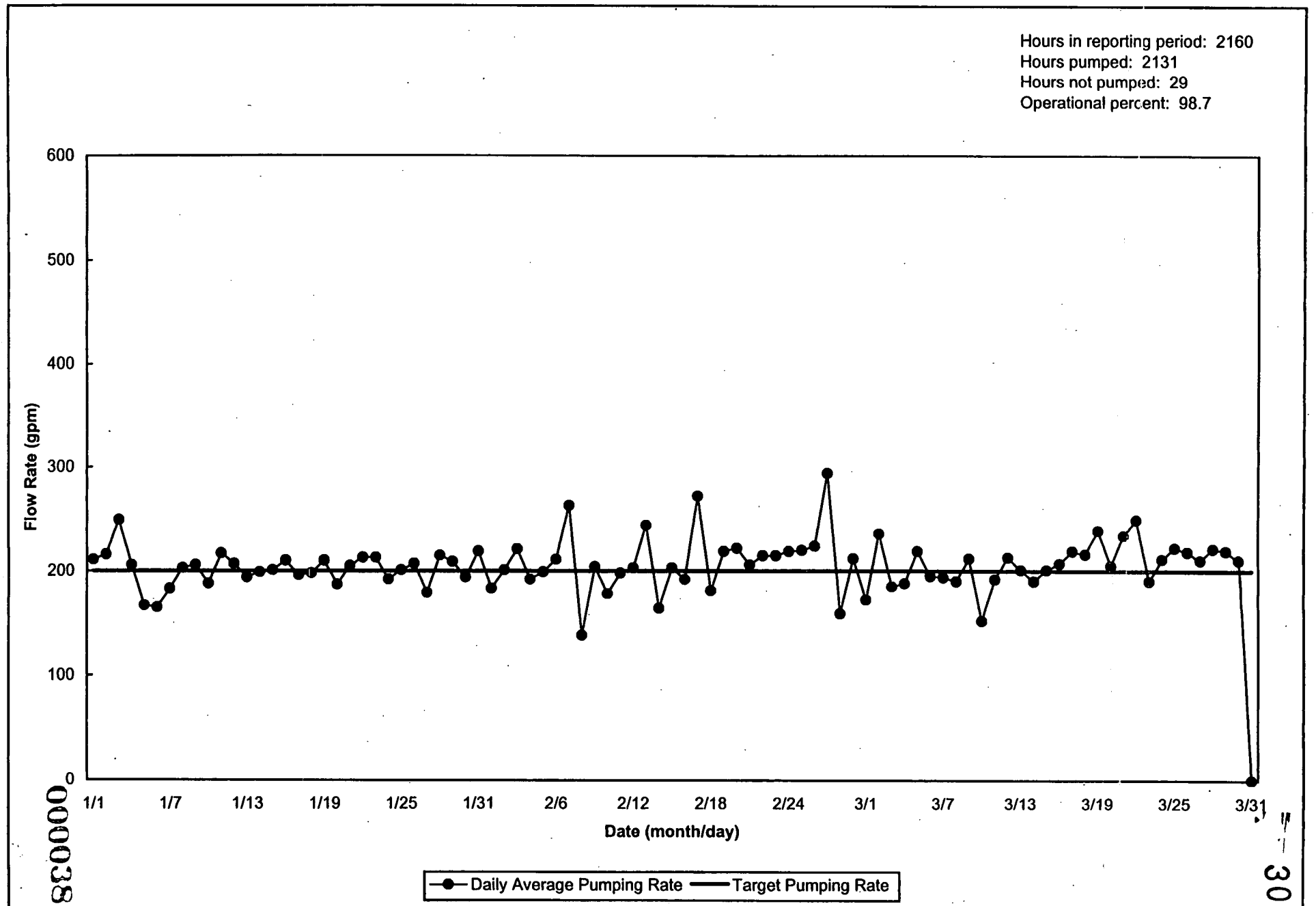


FIGURE 1-11. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31563, 1/00 - 3/00

FINAL

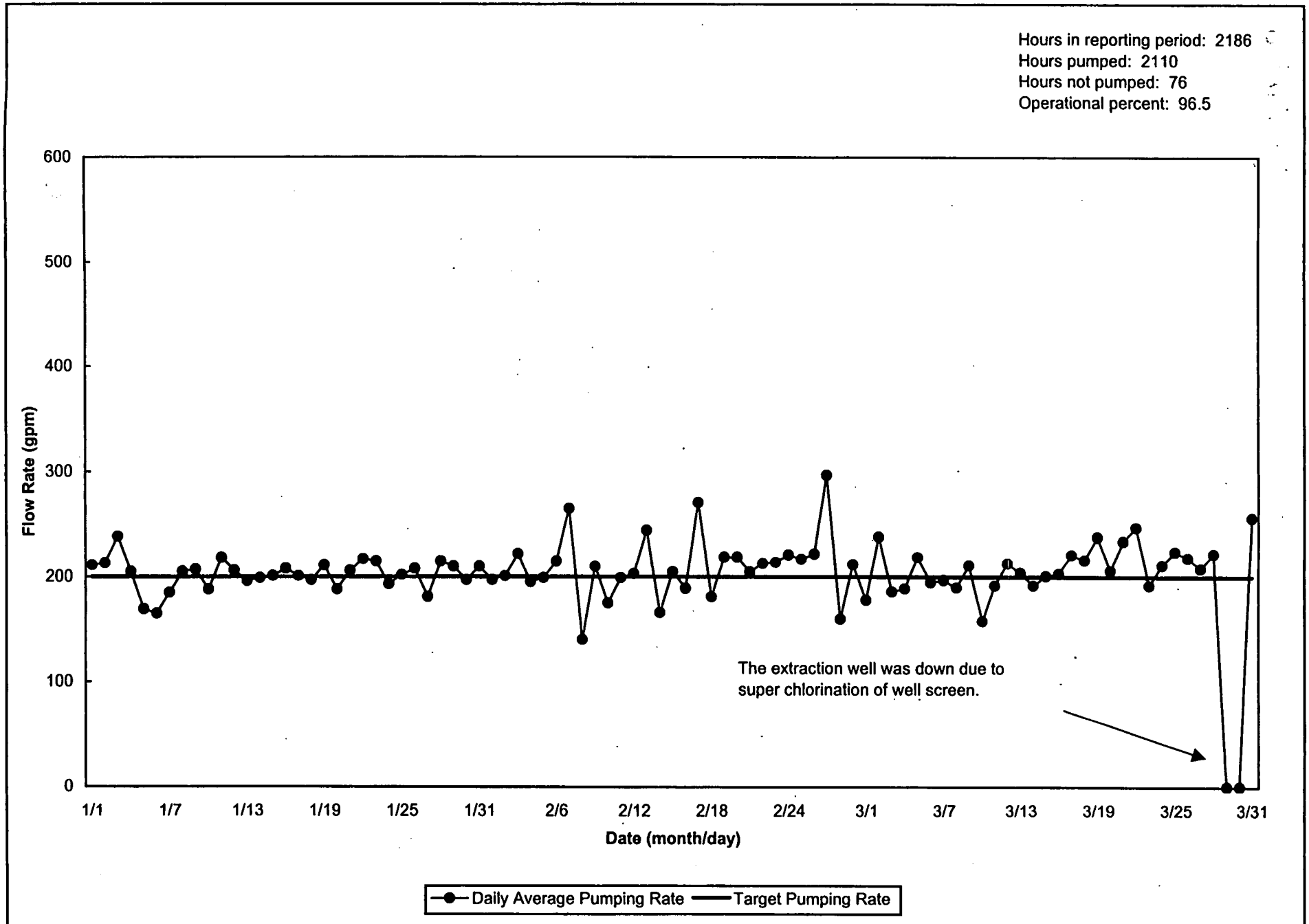


FIGURE 1-12. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31564, 1/00 - 3/00

FINAL

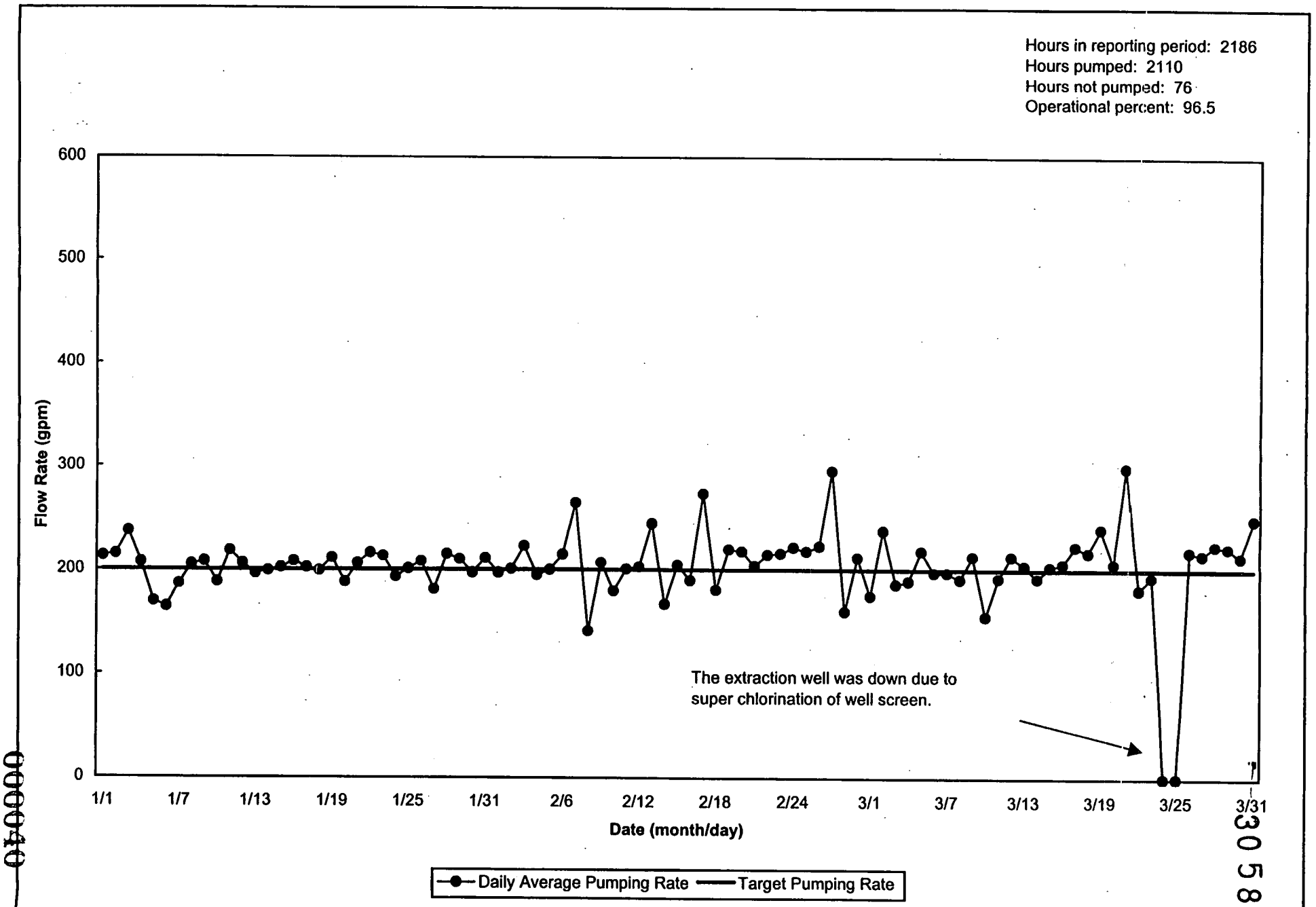
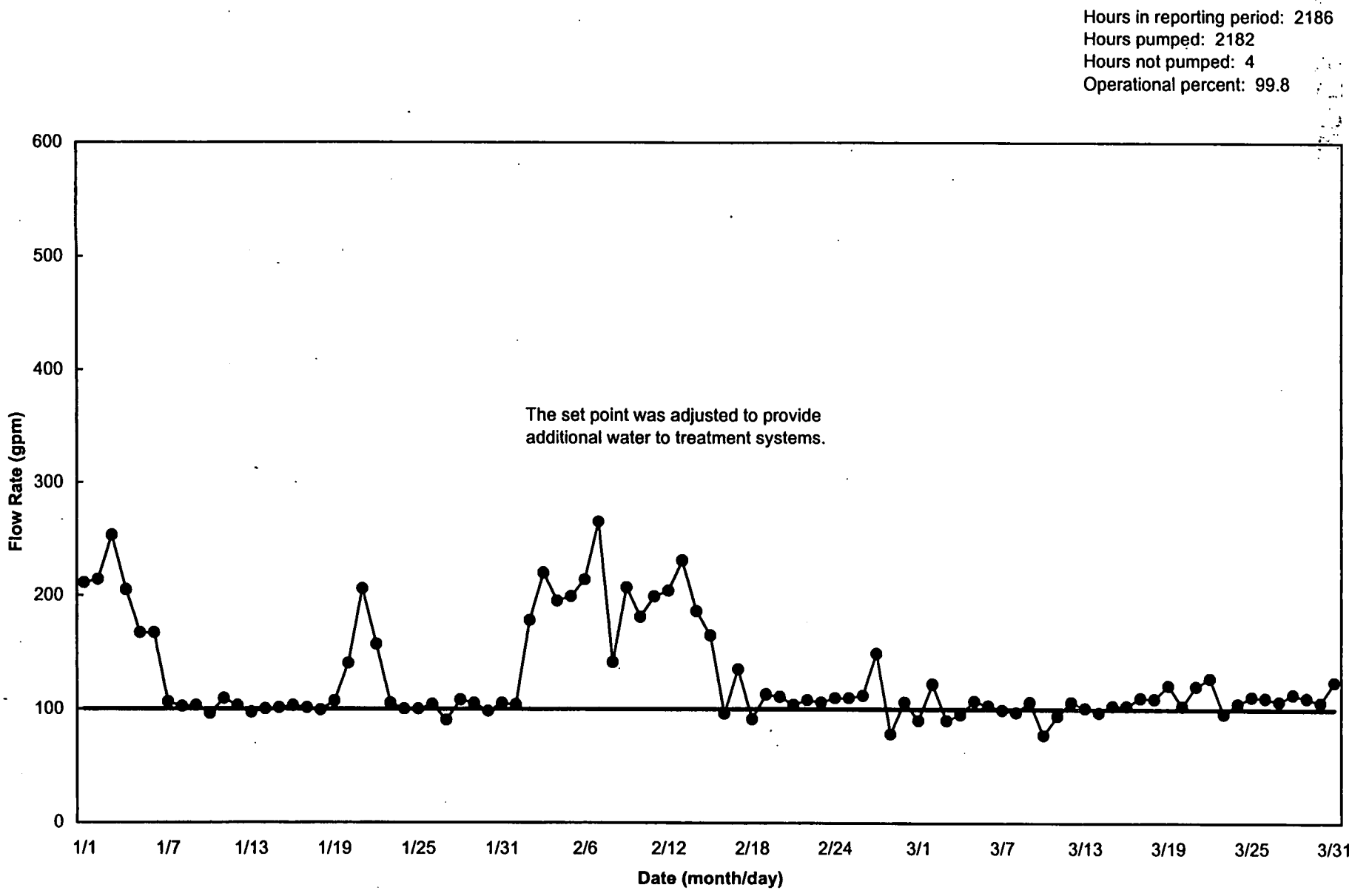


FIGURE 1-13. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31565, 1/00 - 3/00

FINAL



0000041

FIGURE 1-14. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31567, 1/00 - 3/00

FINAL

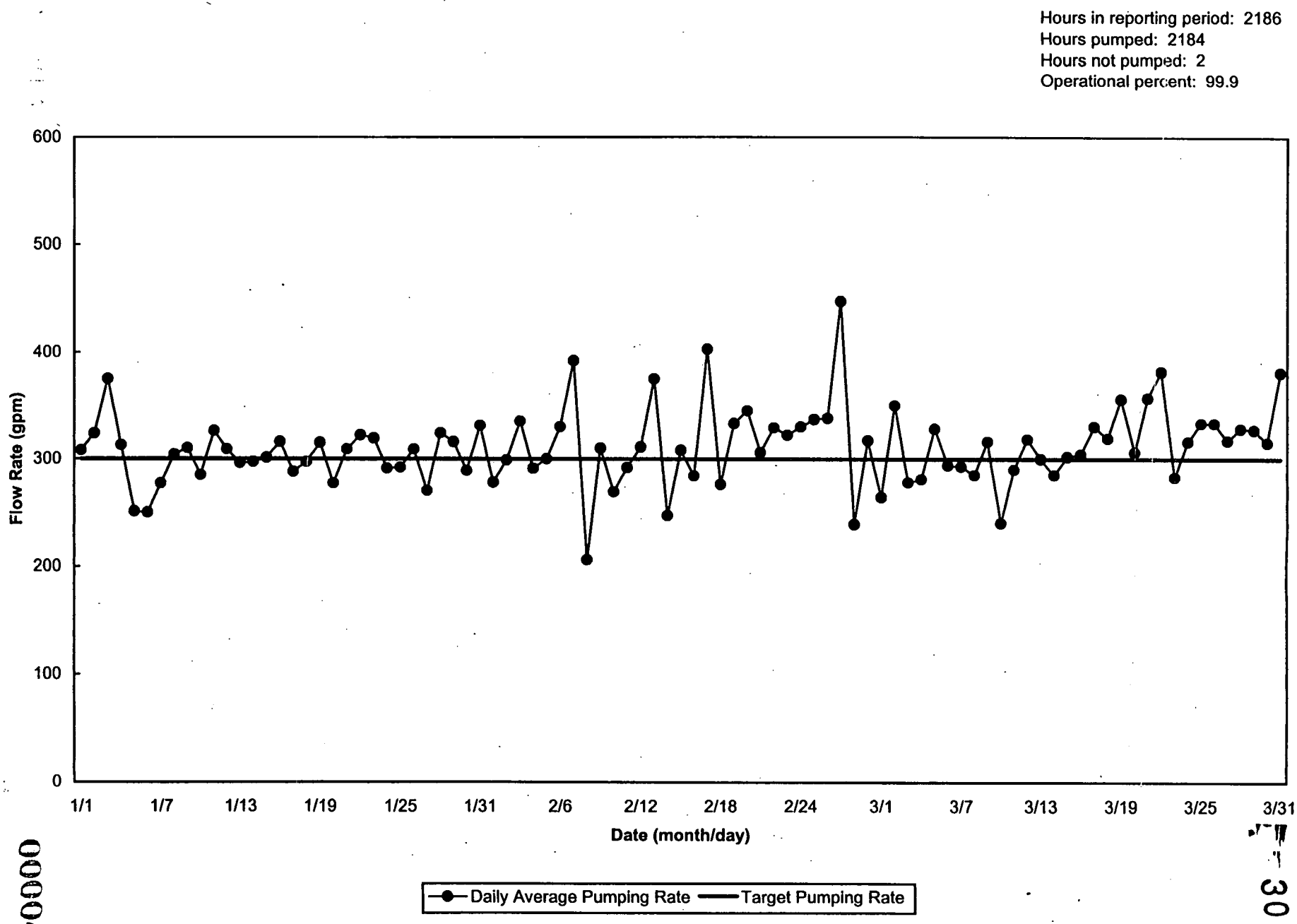


FIGURE 1-15. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 32276, 1/00 - 3/00

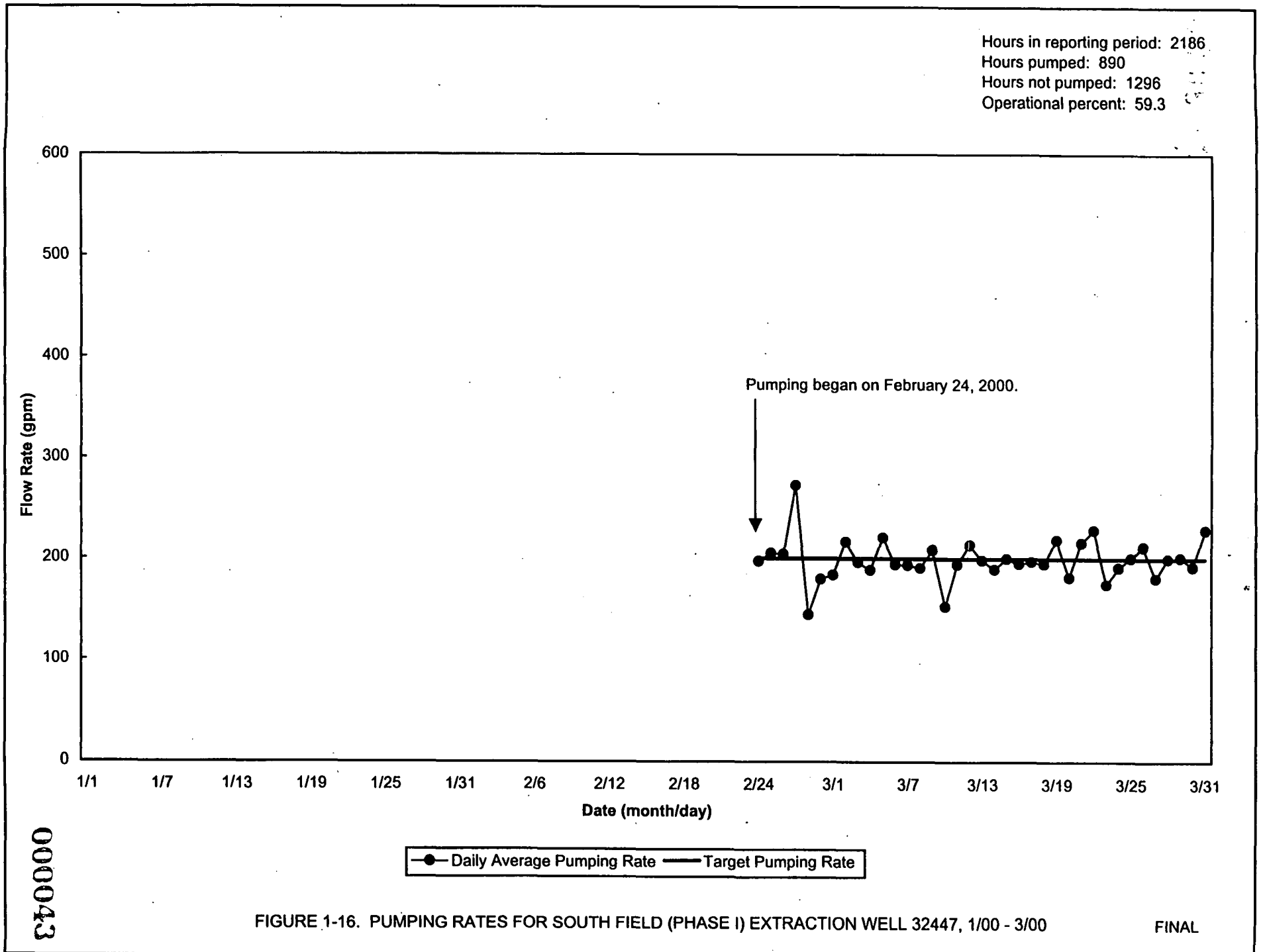


FIGURE 1-16. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 32447, 1/00 - 3/00

FINAL

000043

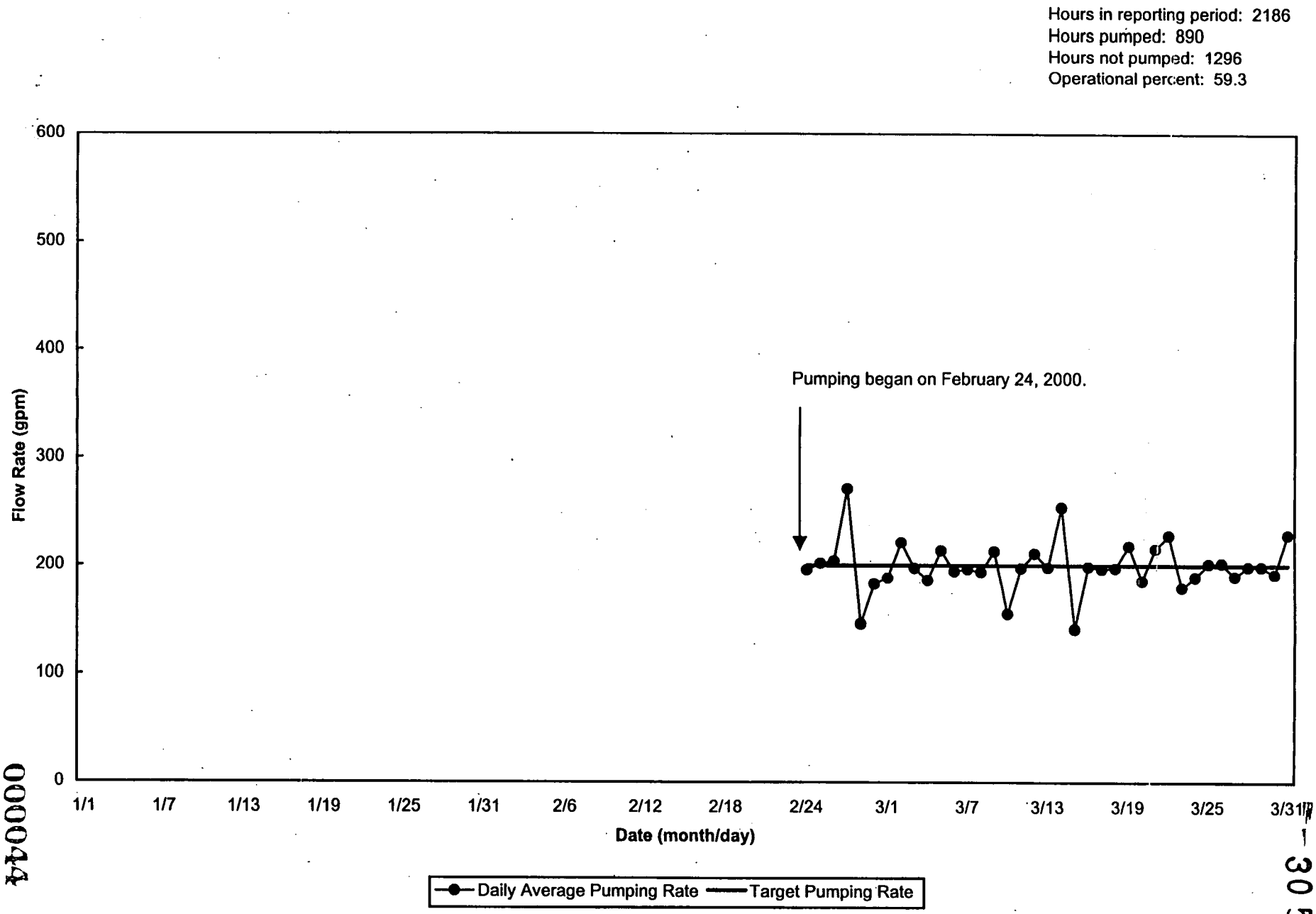
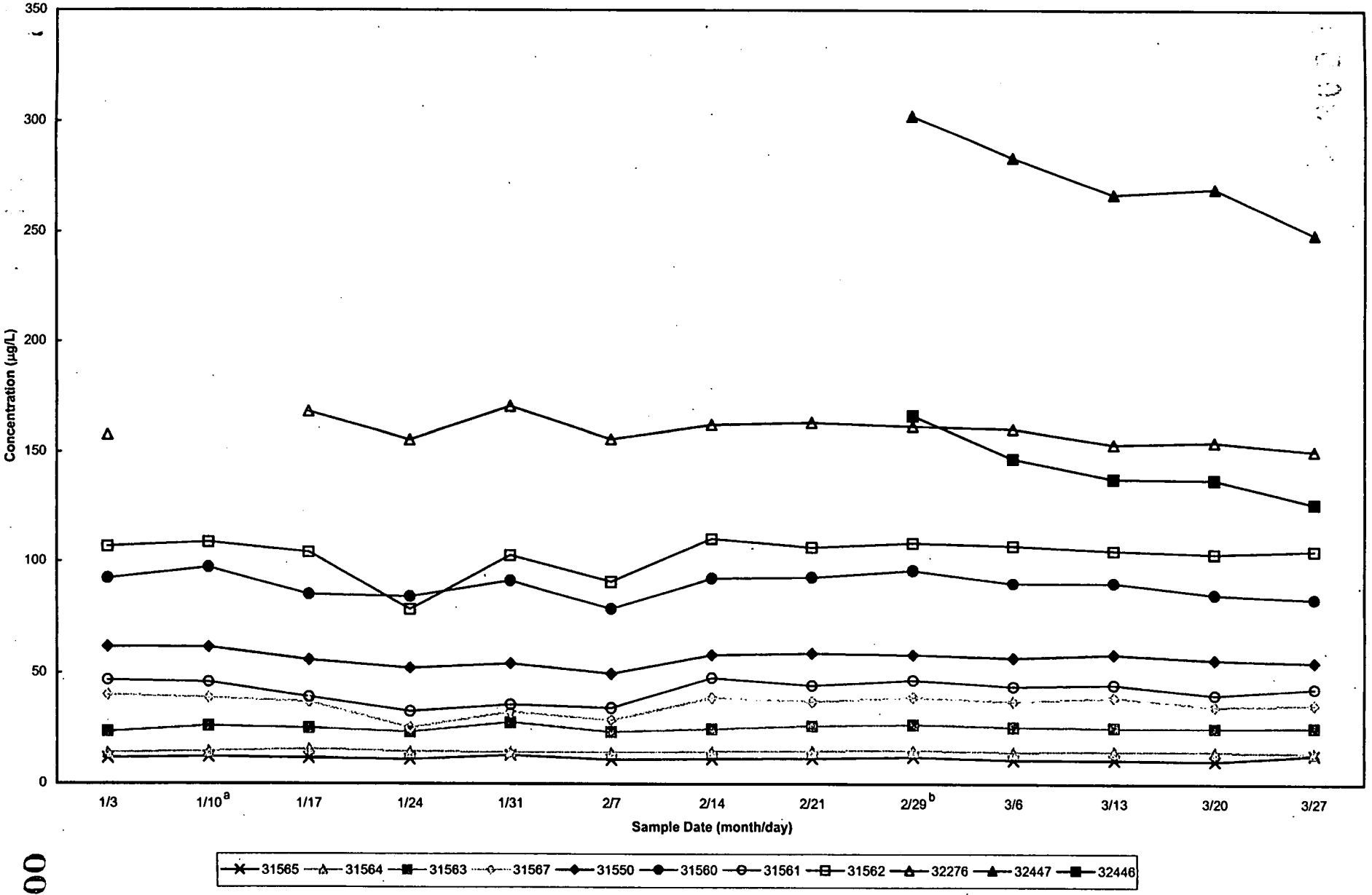


FIGURE 1-17. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 32446, 1/00 - 3/00

FINAL



[a] A sample was not collected for Extraction Well 32276.

[b] Pumping of Extraction Wells 32447 and 32446 began on February 24, 2000.

FIGURE 1-18. WEEKLY TOTAL URANIUM CONCENTRATIONS FOR THE SOUTH FIELD (PHASE I) EXTRACTION MODULE

FINAL

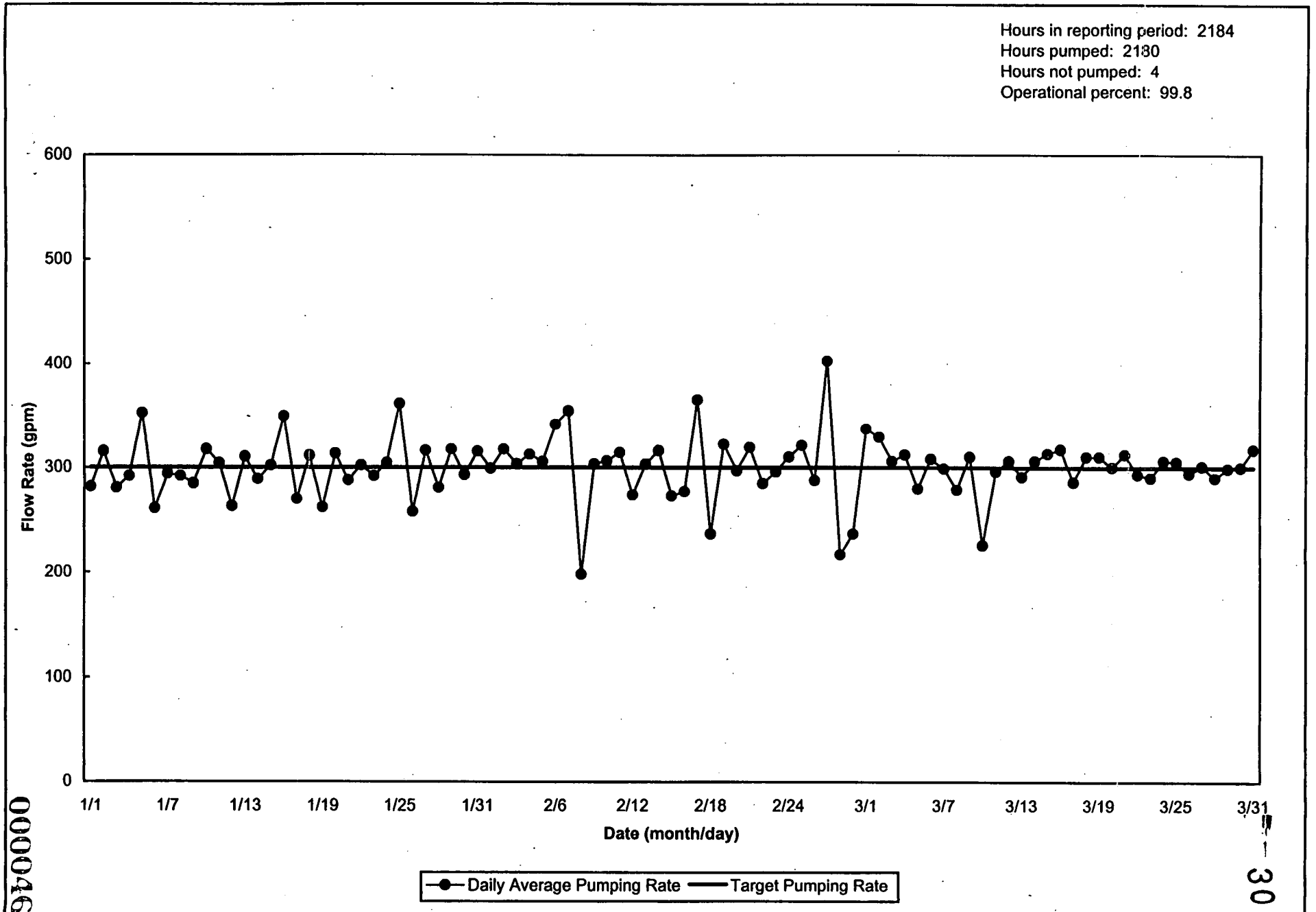


FIGURE 1-19. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3924, 1/00 - 3/00

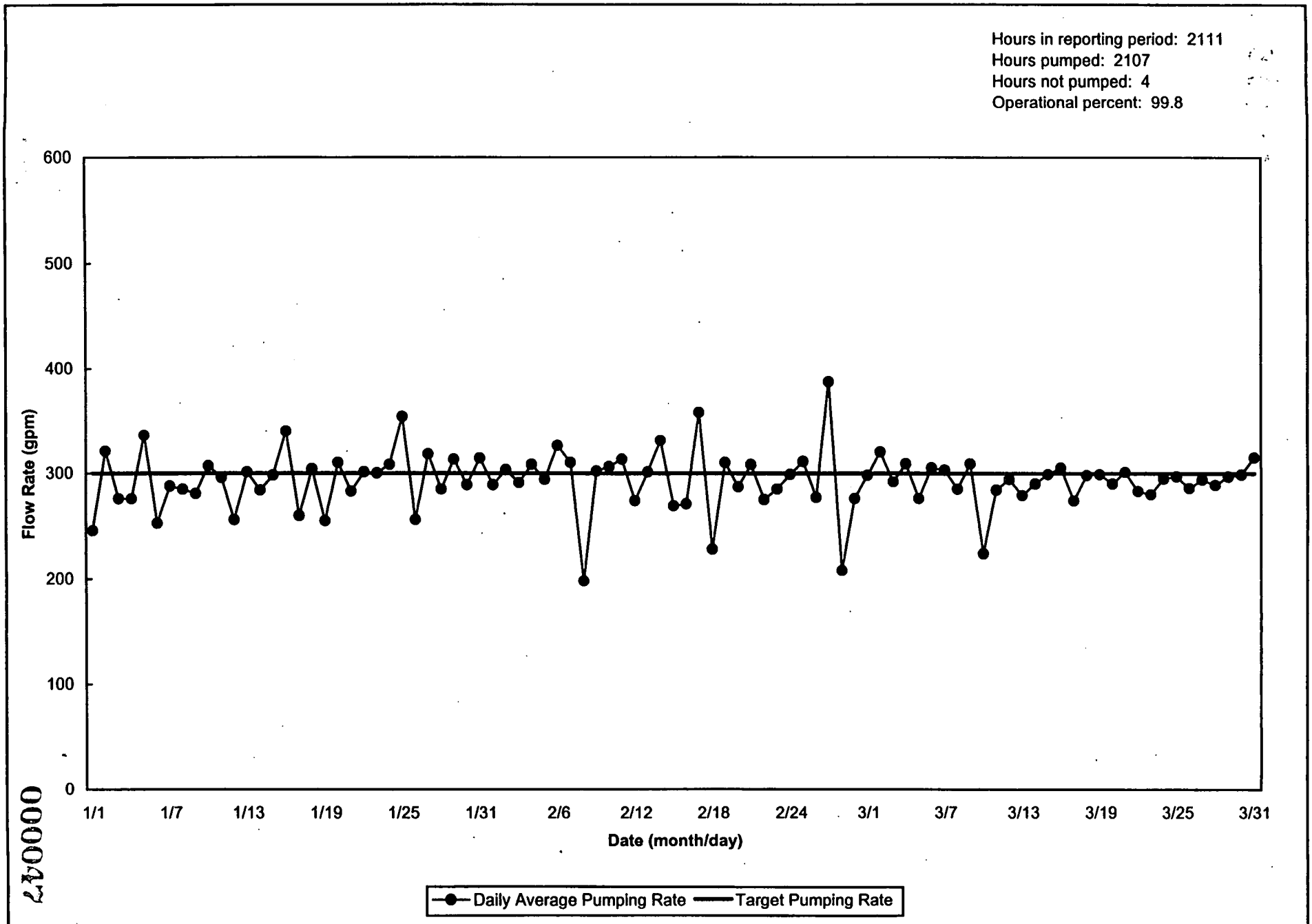


FIGURE 1-20. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3925, 1/00 - 3/00

FINAL

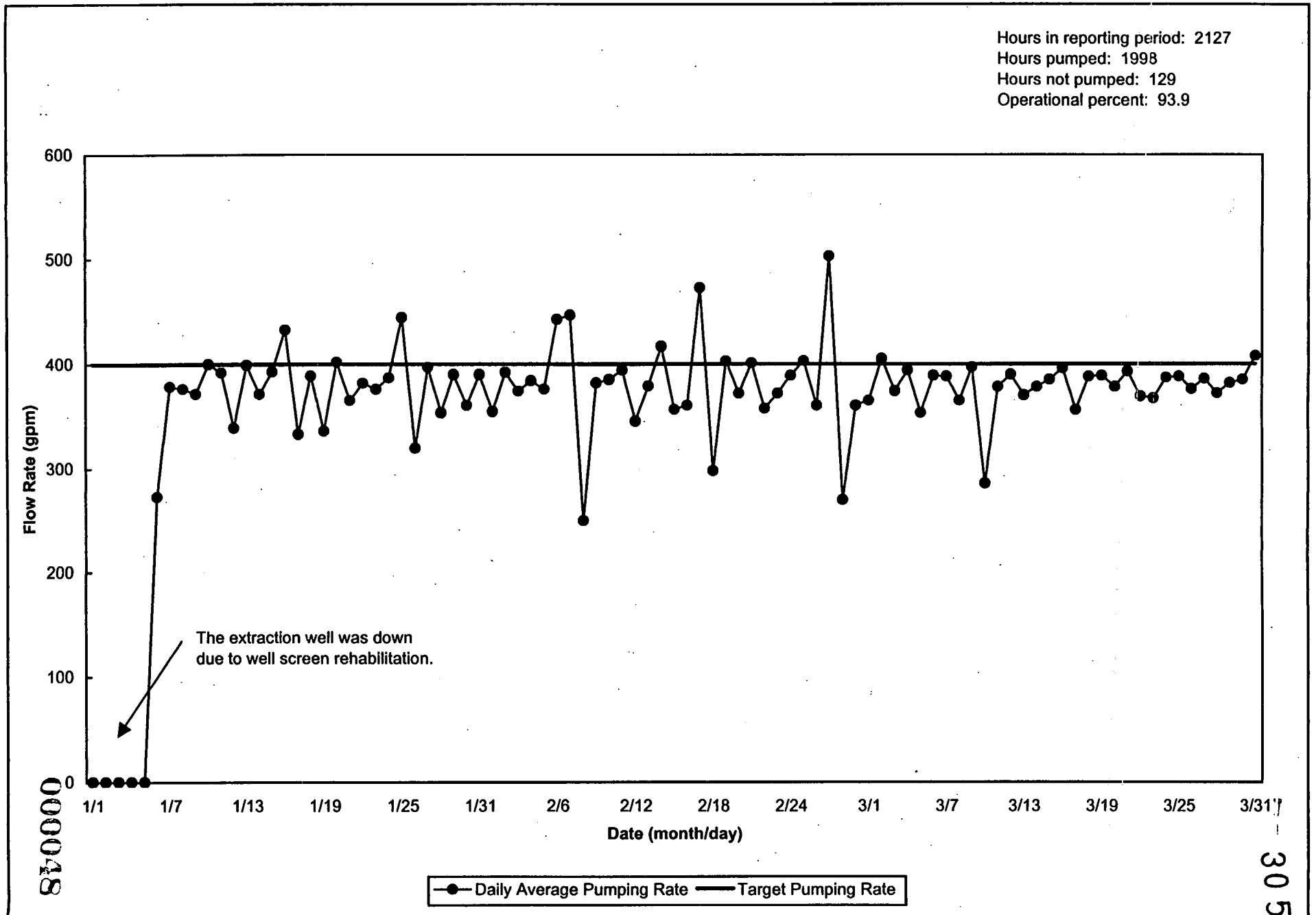


FIGURE 1-21. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3926, 1/00 - 3/00

FINAL

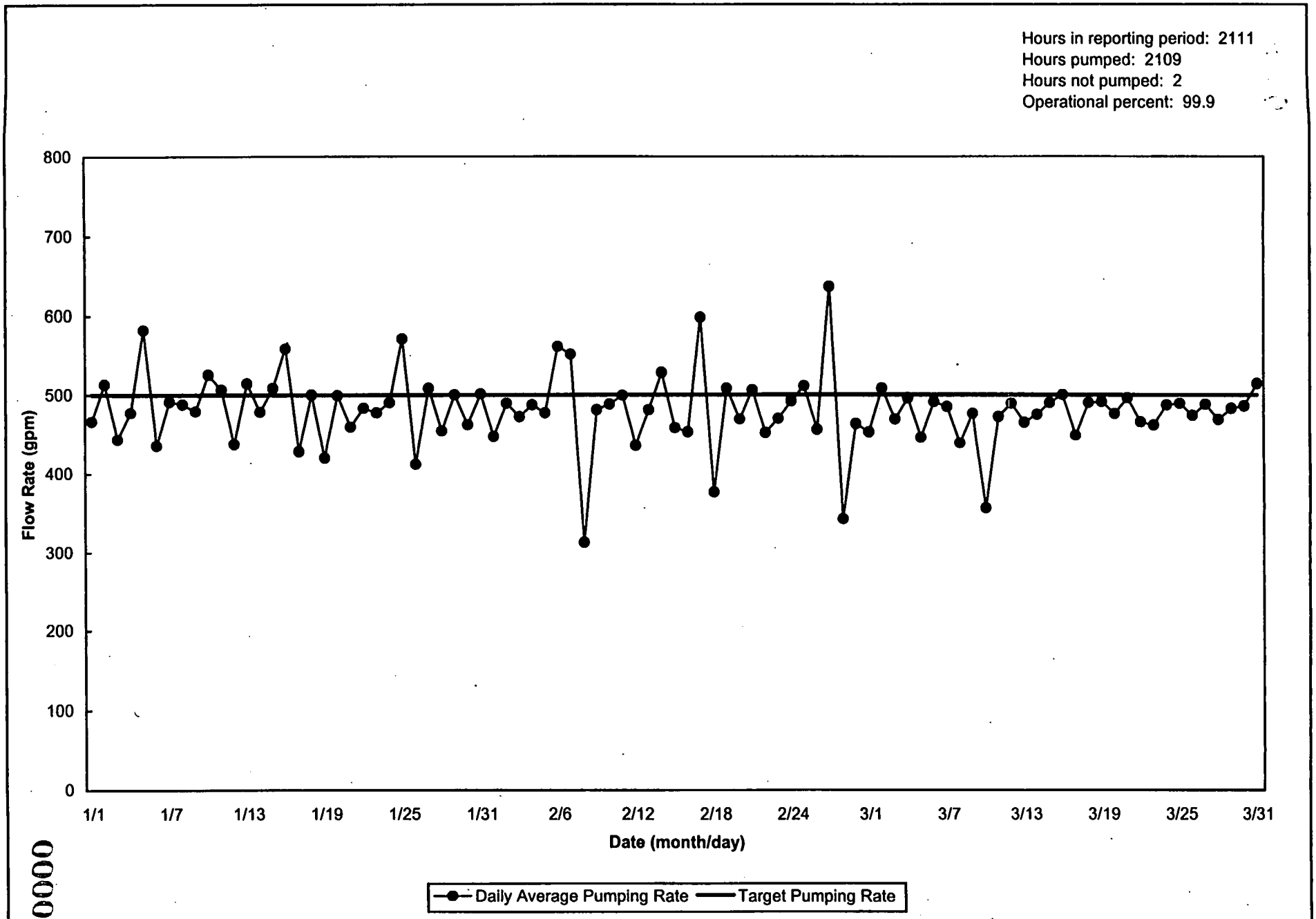


FIGURE 1-22. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3927, 1/00 - 3/00

FINAL

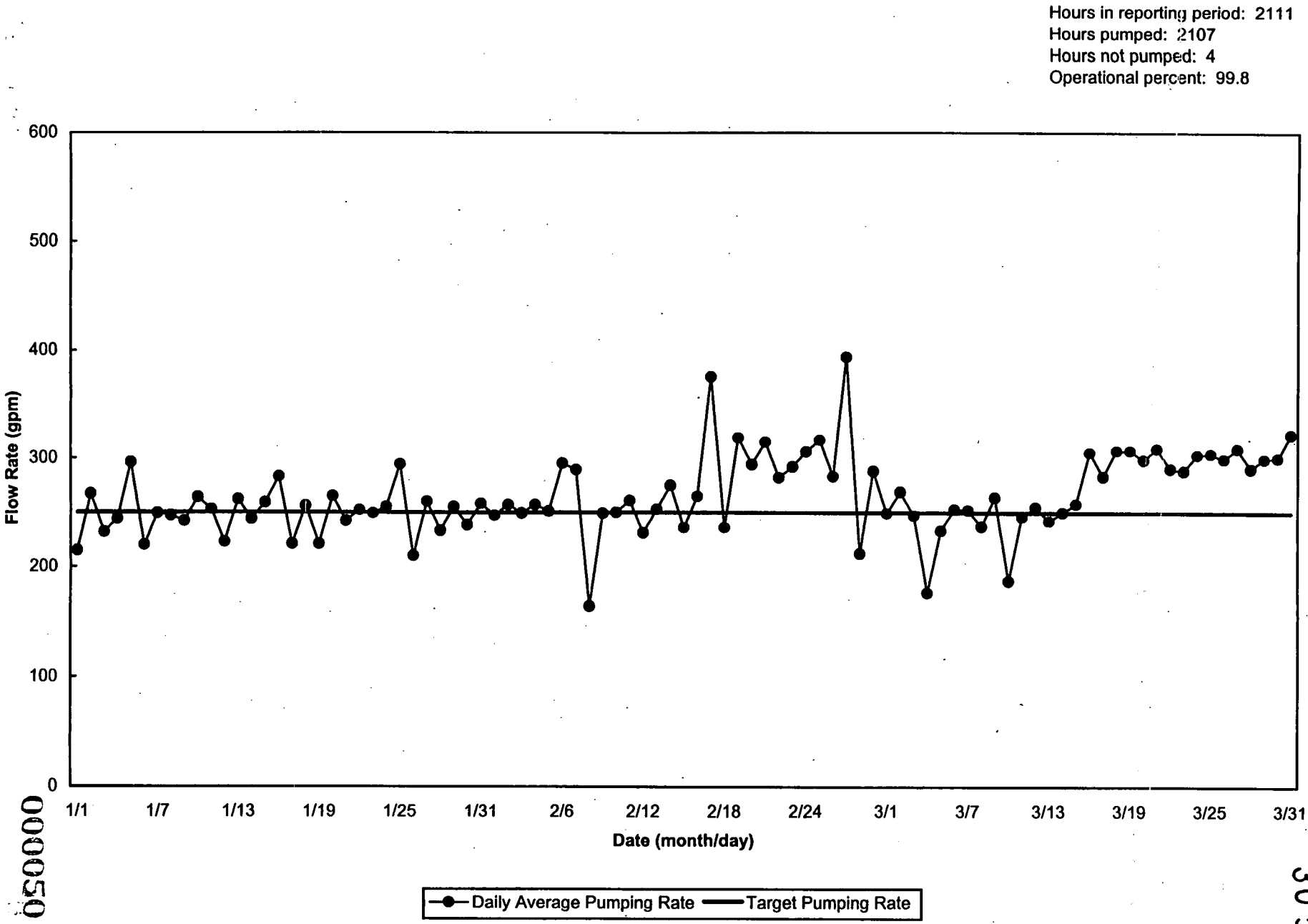


FIGURE 1-23. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 32308, 1/00 - 3/00

FINAL

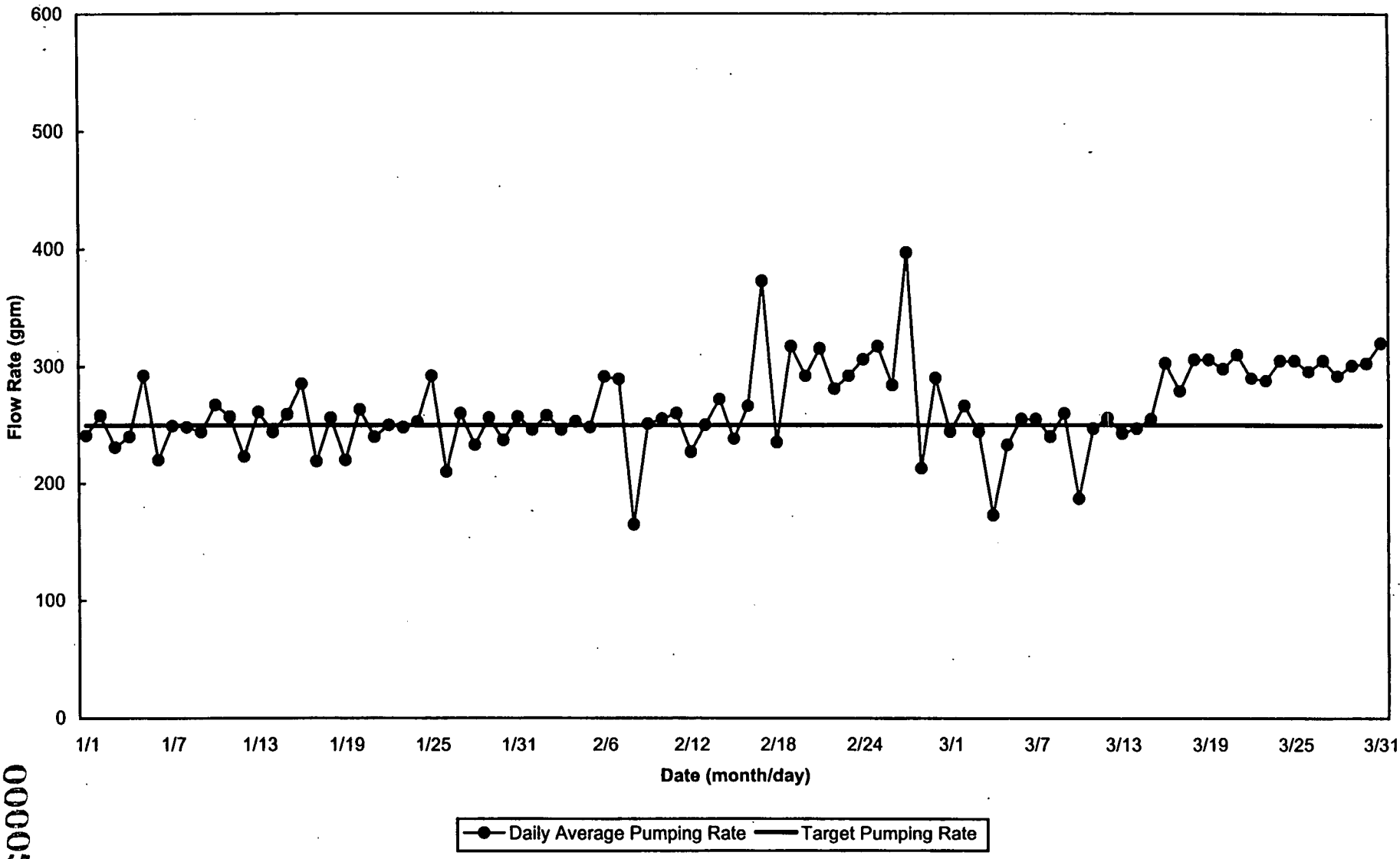
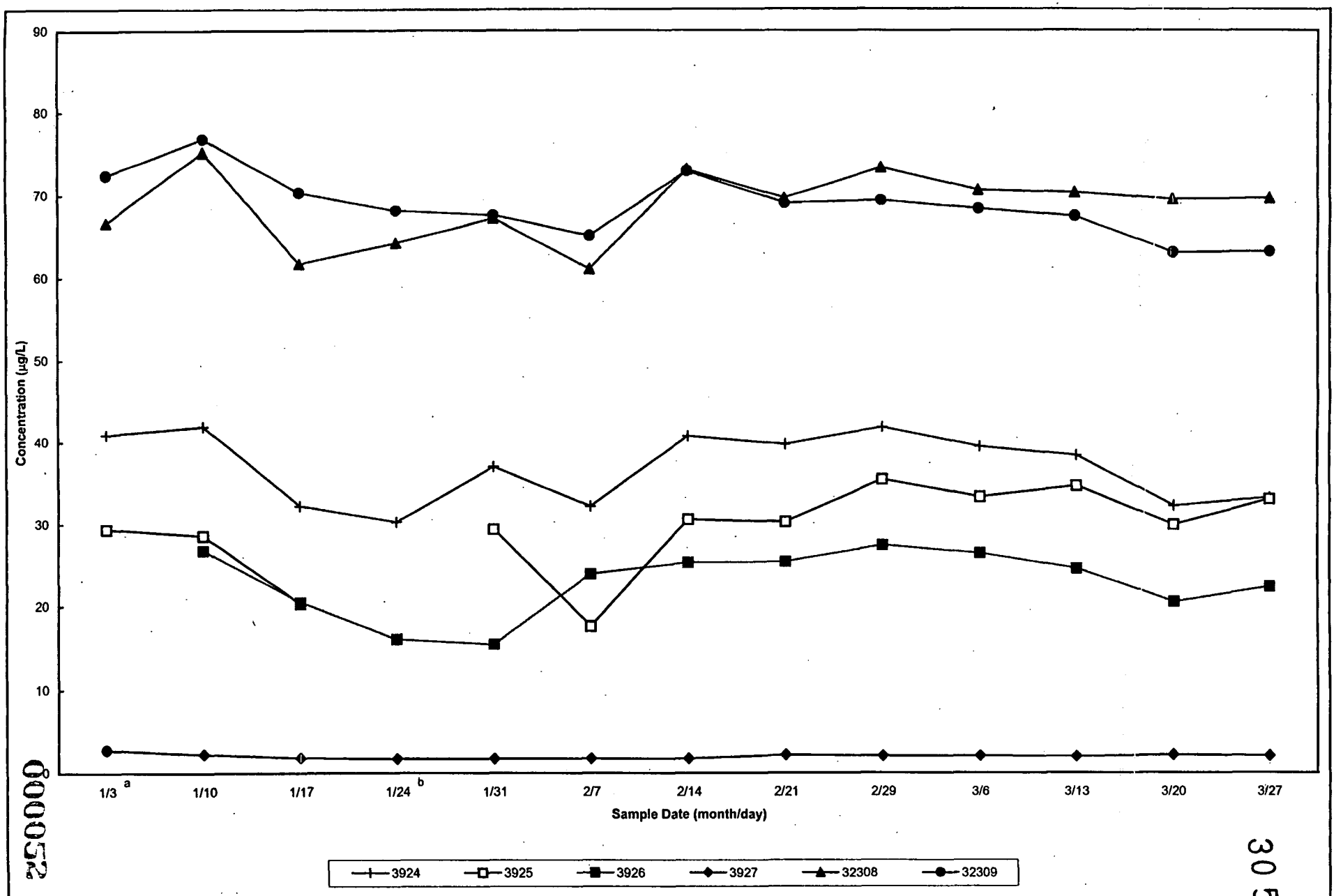


FIGURE 1-24. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 32309, 1/00 - 3/00

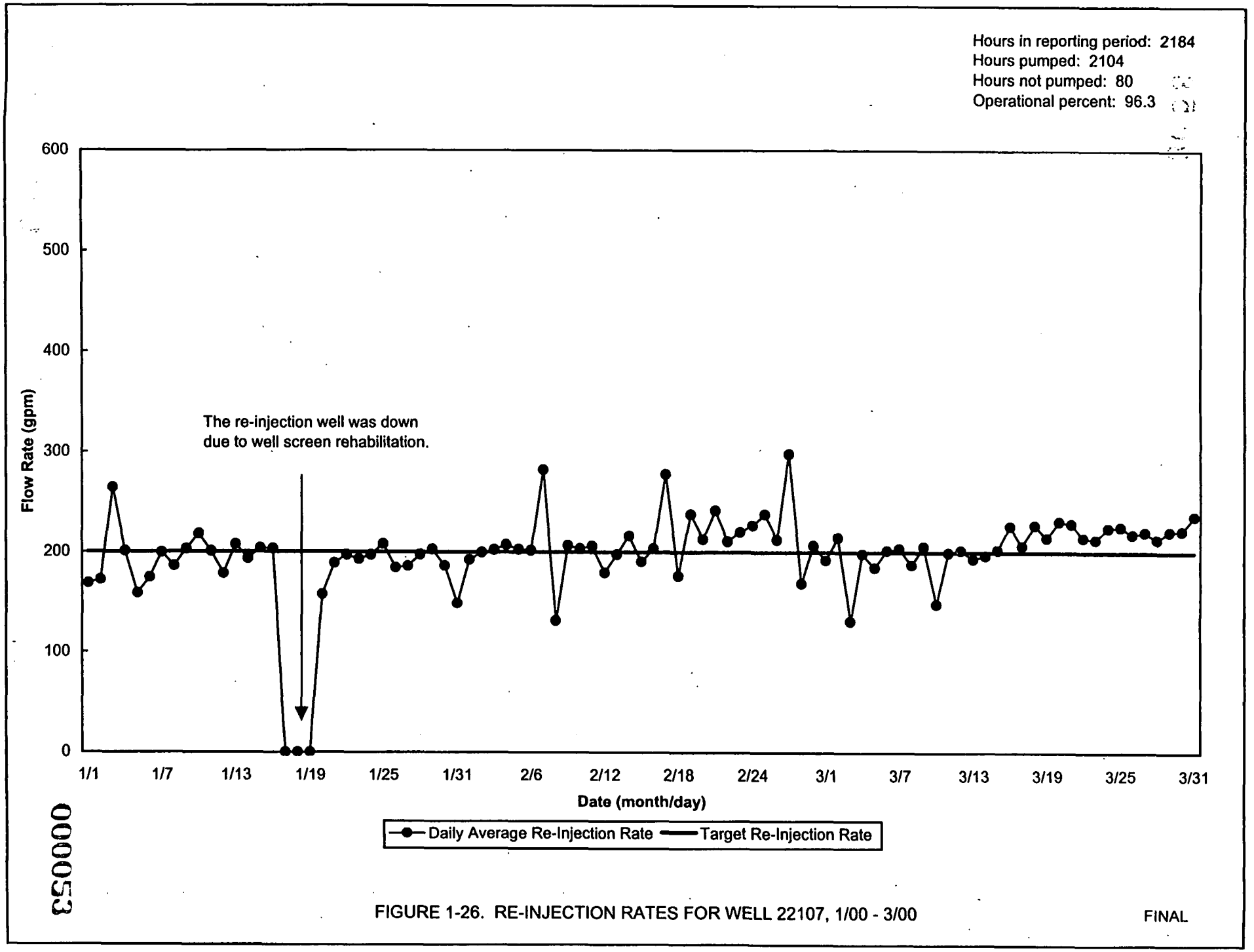
FINAL



a A sample was not collected for Extraction Well 3926.

b A sample was not collected for Extraction Well 3925.

FIGURE 1-25. WEEKLY TOTAL URANIUM CONCENTRATIONS FOR THE SOUTH PLUME MODULE



000053

FIGURE 1-26. RE-INJECTION RATES FOR WELL 22107, 1/00 - 3/00

FINAL

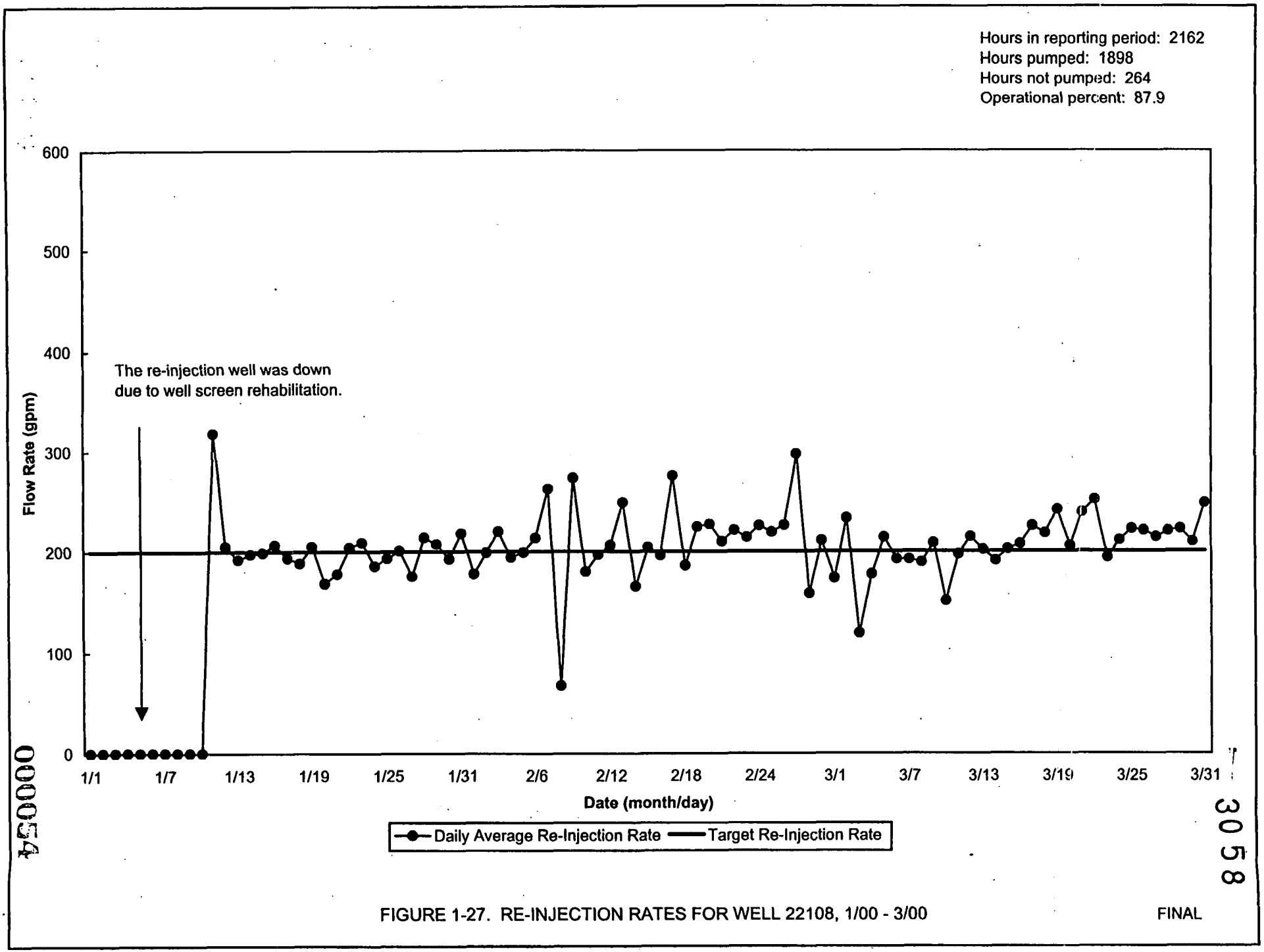


FIGURE 1-27. RE-INJECTION RATES FOR WELL 22108, 1/00 - 3/00

FINAL

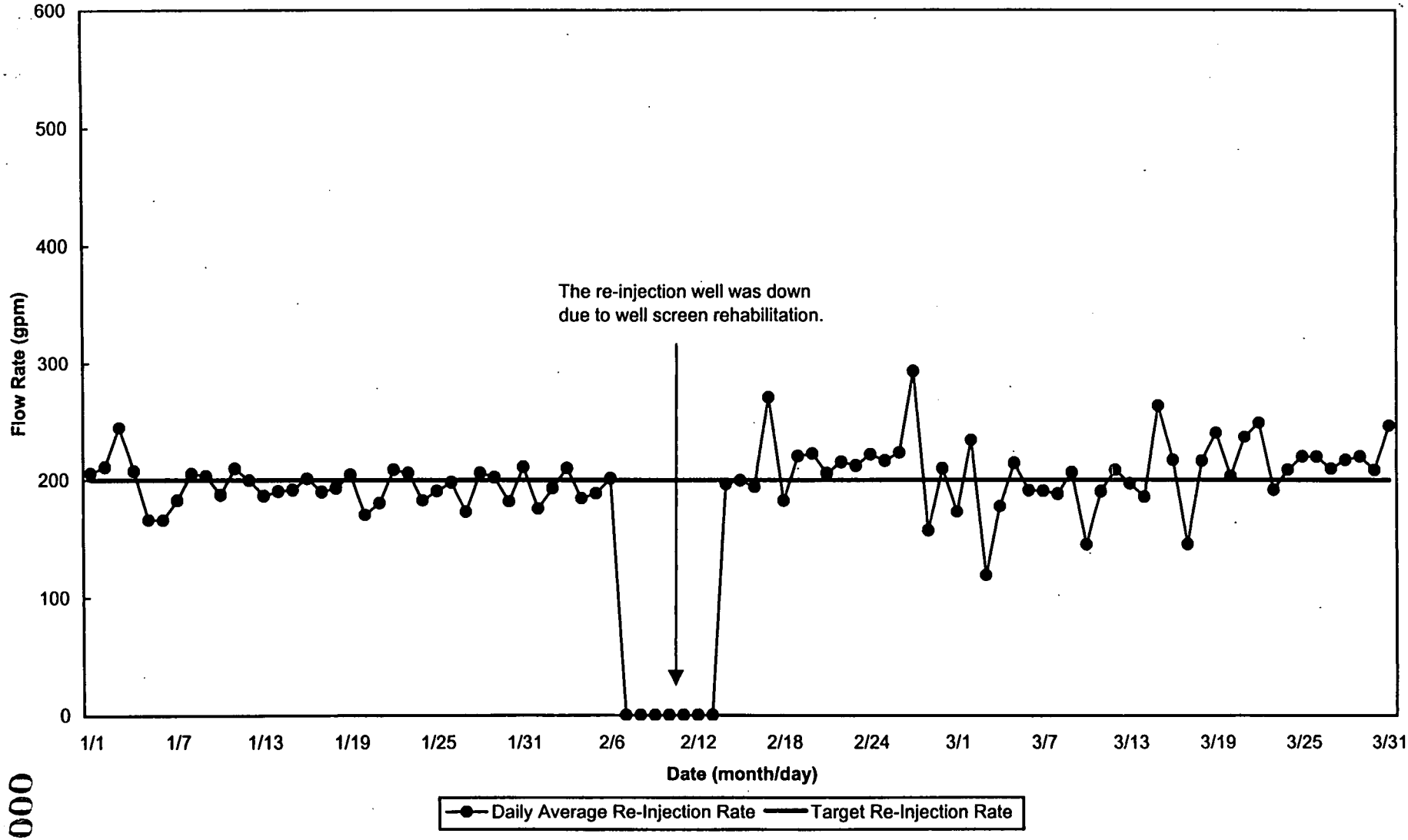


FIGURE 1-28. RE-INJECTION RATES FOR WELL 22109, 1/00 - 3/00

FINAL

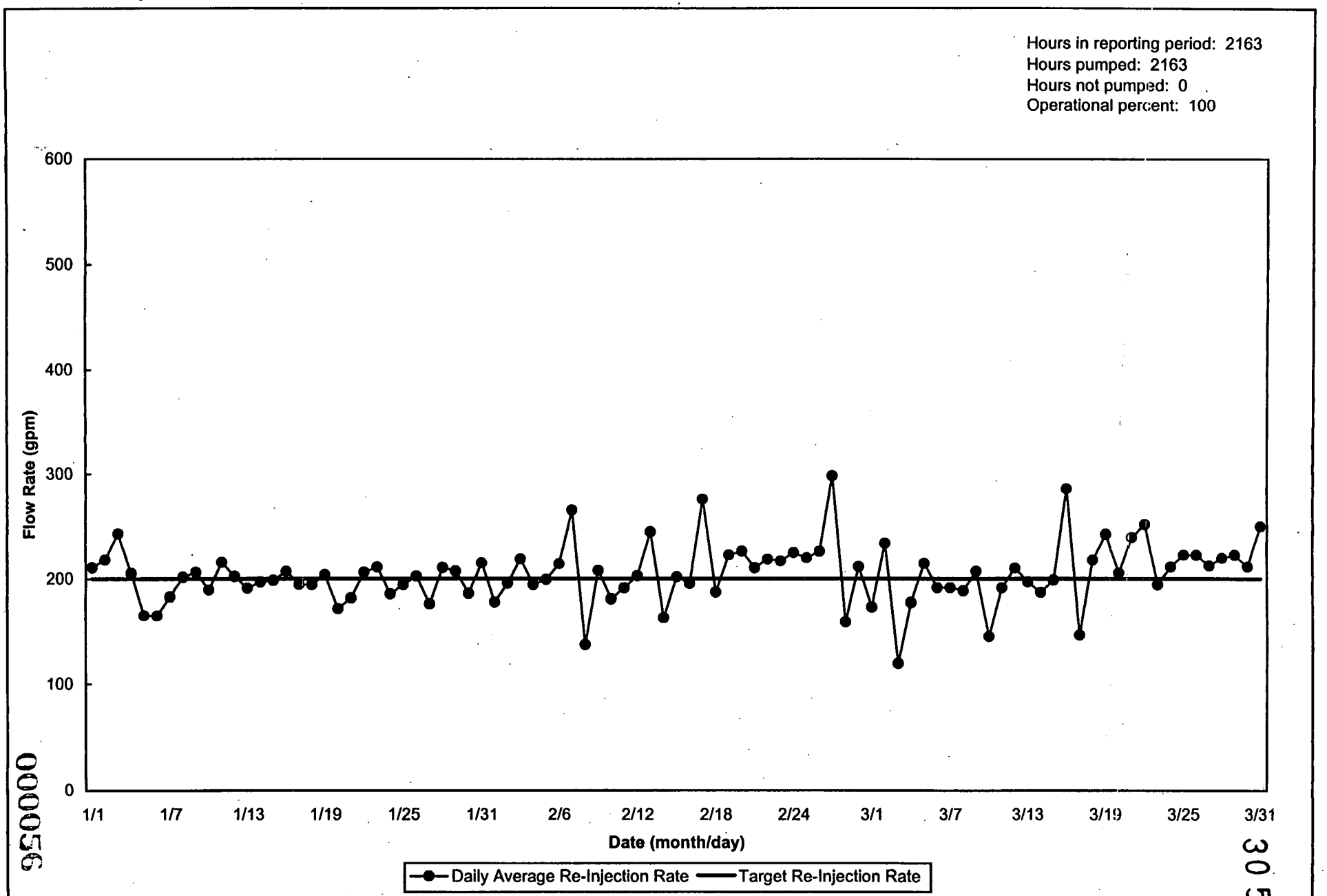


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FIGURE 1-29. RE-INJECTION RATES FOR WELL 22111, 1/00 - 3/00

FINAL

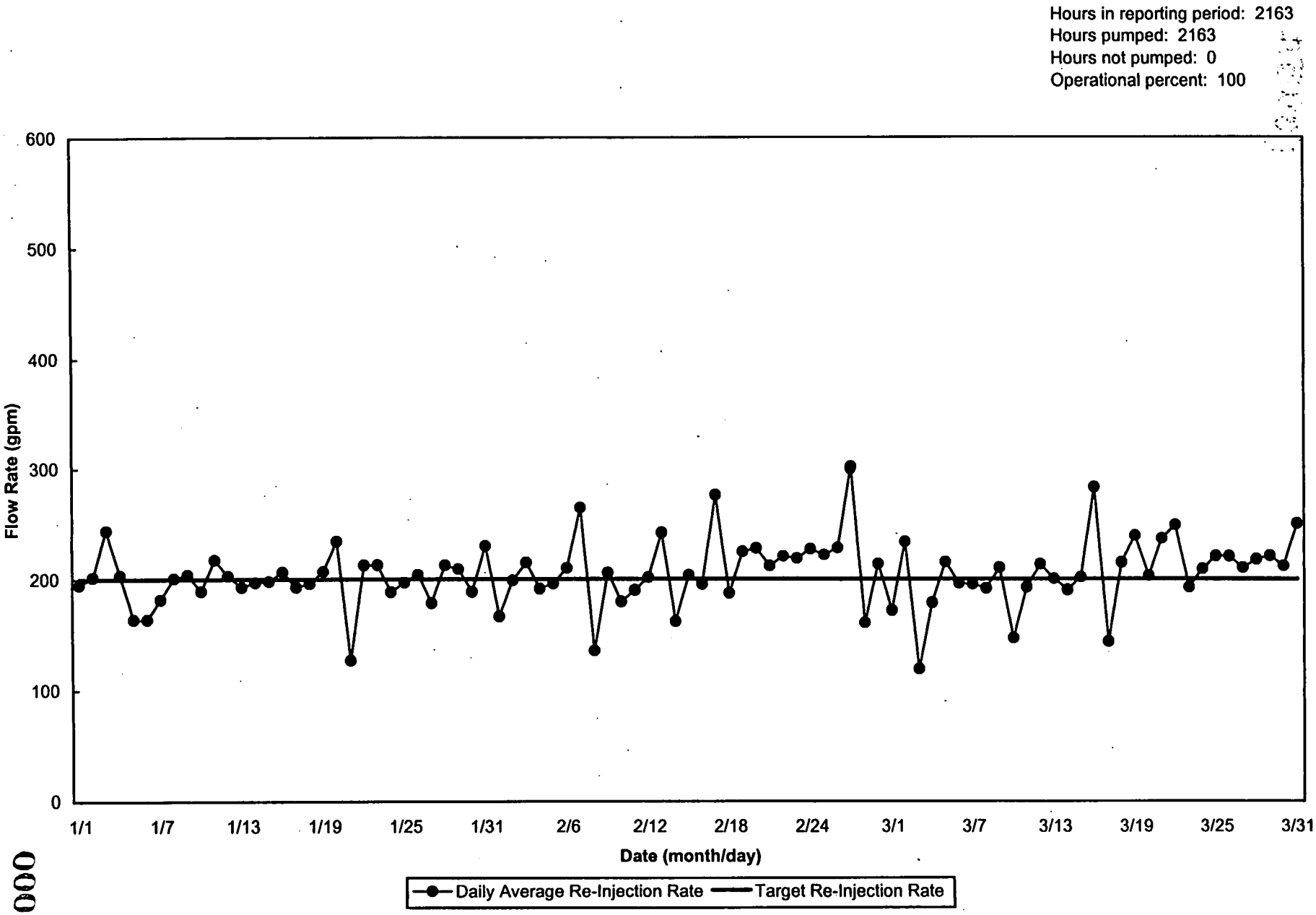
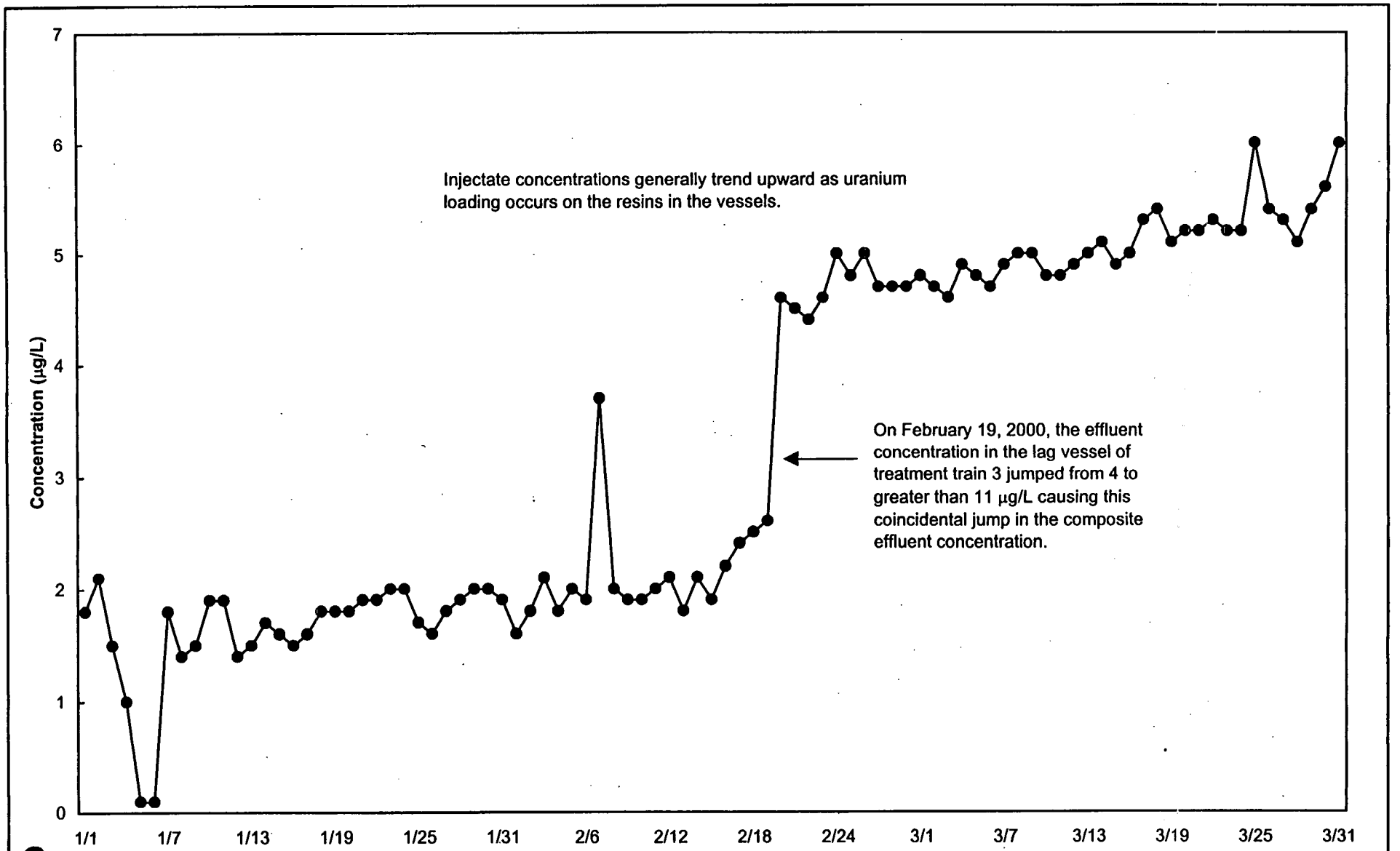


FIGURE 1-30. RE-INJECTION RATES FOR WELL 22240, 1/00 - 3/00

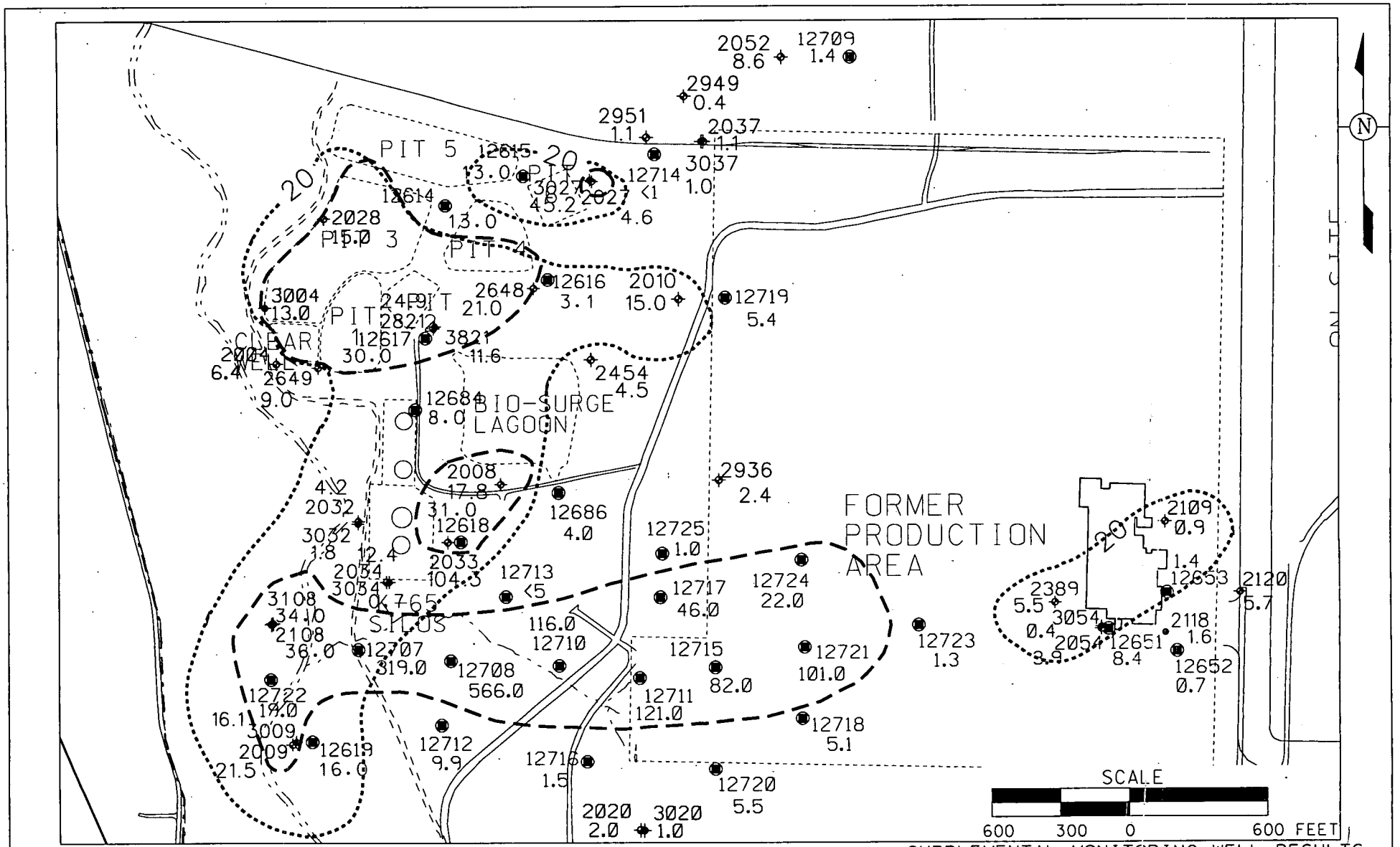
FINAL



Notes: 1) Total uranium concentration required to be less than 20 µg/L.
2) Injectate uranium concentrations are derived from the daily composite samples of effluent from Phase III of the AOWT, the source of the injectate.

FIGURE 1-31. TOTAL URANIUM CONCENTRATIONS IN INJECTATE, 1/00 - 3/00

FINAL



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V:/5FGP1/DGN/000TR1/000T1003.DGN 21-JUN-2000
STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 1-32. TOTAL URANIUM PLUME UPDATE

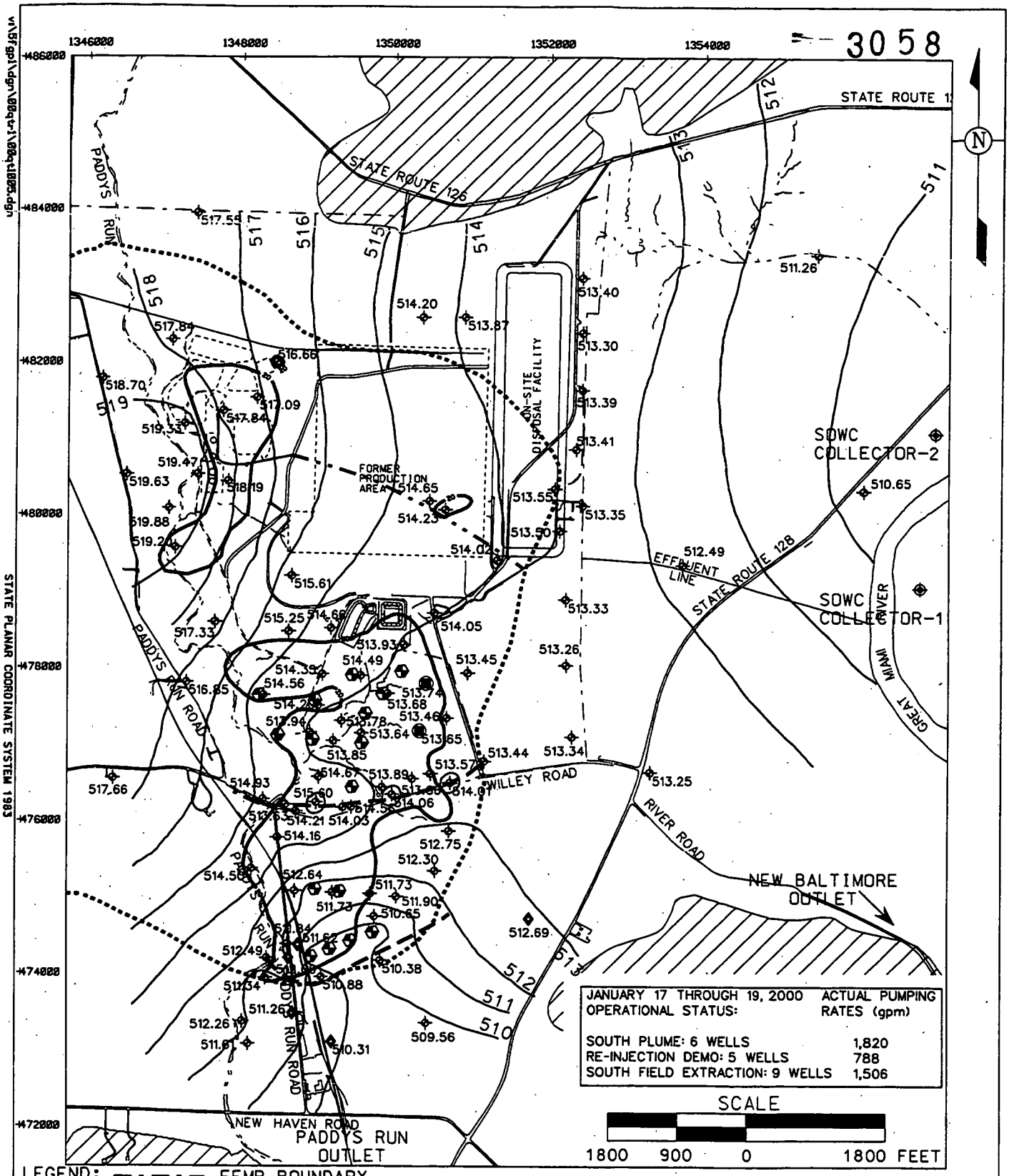

FIGURE 1-33. ROUTINE GROUNDWATER ELEVATIONS FOR TYPE 2 WELLS, JANUARY 2000

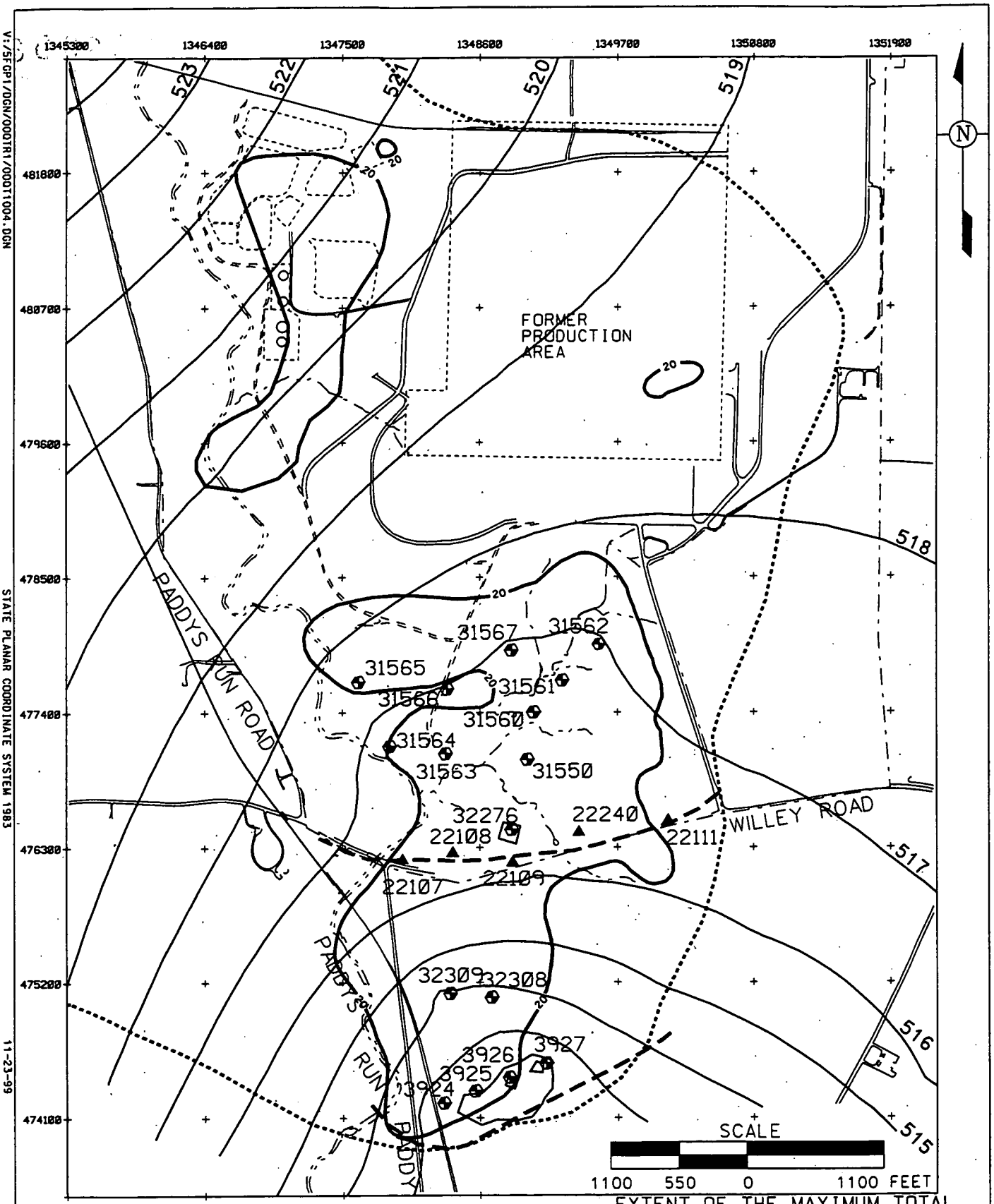

FIGURE 1-34. COMPARISON OF MODELED GROUNDWATER ELEVATIONS WITH INTERPRETED CAPTURE ZONES

On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring

2.0 ON-SITE DISPOSAL FACILITY GROUNDWATER/LEAK DETECTION AND LEACHATE MONITORING

This section summarizes the first quarter 2000 leachate collection system (LCS) and leak detection system (LDS) volume data. Analytical results from the on-site disposal facility leak detection sampling activities conducted from October through December 1999 (fourth quarter) were provided in the 1999 Integrated Site Environmental Report (DOE 2000a) submitted June 1, 2000. The material in this section satisfies the groundwater reporting requirements presented in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a).

Figure 2-1 shows the sampling activities that contributed data to this section. Figure 2-2 identifies the well locations associated with the on-site disposal facility.

Figure 2-1 also shows the on-site disposal facility leak detection monitoring activities to be summarized in the next IEMP quarterly status report to be submitted in September of 2000. The report will contain LCS and LDS volume data from April through June 2000 (second quarter), and analytical results from on-site disposal facility leak detection sampling activities conducted from January through March 2000 (first quarter).

2.1 CELL 1

Due to the winter shutdown, March was the only month during the quarter when waste was placed in Cell 1. At the end of March, Cell 1 was approximately 81 percent full.

2.1.1 CELL 1 LEAK DETECTION SYSTEM VOLUMES

Volumes pumped from the Cell 1 LDS for the first quarter of 2000 are as follows: January (261 gallons); February (0 gallons); and March (0 gallons). The January volumes are not considered representative of LDS accumulation rates as a malfunctioning valve was discovered to be allowing backflow from the leachate pipeline to enter the primary containment vessel. The malfunctioning valve was replaced with a more reliable valve in the latter portion of the month.

Figure 2-3 depicts quantitative weekly measurement of the LDS water accumulation rates along with summary statistics (minimum, maximum, and average) for the quarter. In past reports, accumulation rates based on pump outs of the primary containment vessel were provided. The weekly accumulation rates are being provided now as a refinement because of the general decrease in accumulation rates. The decreases have been such that only one pump-out of the Cell 1 LDS primary containment vessel occurred in the first quarter of 2000. Figure 2-3 also provides the weekly precipitation amounts corresponding to each accumulation period. The precipitation data were added in an effort to determine if a correlation exists between precipitation and the LDS accumulation rate. Based on review of Figure 2-3, it does not appear that there is a strong correlation between precipitation and the Cell 1 LDS accumulation rates. However, the increased accumulation rate for the week ending March 8 appears to be in response to precipitation events during the weeks ending on February 16 and February 23. Likewise, the increased accumulation rate for the week ending March 29 appears to be in response to the precipitation events during the weeks ending March 16 and March 22.

The accumulation rates for the first quarter ranged from 0.01 gallons per acre per day (gpad) to 0.23 gpad with an average of 0.13 gpad. The first quarter average is considerably lower than the previously reported May through December 1999 average of 0.52 gpad. The LDS accumulation rate at the end of the quarter was 0.1 gpad. This equates to a yield of about 1 pint of water per acre per day. The ongoing accumulation rate measurements indicate that the liner system for Cell 1 continues to perform such that the accumulation rates are far below (quarterly average is more than two orders of magnitude below) the on-site disposal facility design-established initial response leakage rate of 20 gpad.

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2.1.2 CELL 1 ANALYTICAL STATUS

The most recent data (fourth quarter 1999) were reported through the 1999 Integrated Site Environmental Report submitted to the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA) on June 1, 2000.

2.2 CELL 2

Due to the winter shutdown, March was the only month during the quarter when waste was placed in Cell 2. At the end of March, Cell 2 was approximately 41 percent full.

2.2.1 CELL 2 LEAK DETECTION SYSTEM VOLUMES

Volumes pumped from the Cell 2 LDS for the first quarter of 2000 are as follows: January (0 gallons); February (97.5 gallons); and March (100.9 gallons). The valve designed to prevent leachate backflow into the leak detection system primary containment vessel was replaced with a more reliable valve in February. This valve change was completed because a similar valve for Cell 1 was found to be malfunctioning in January (reference Section 2.1.1).

During the first quarter of 2000, the accumulation rate into the Cell 2 LDS primary containment vessel began to increase, after declining in the third and fourth quarters of 1999. Figure 2-4 depicts quantitative weekly measurements of the LDS water accumulation rates along with summary statistics (minimum, maximum, and average) for the quarter. In past reports, the accumulation rates based on pump outs of the primary containment vessel were provided. The weekly accumulation rates are being provided now as a refinement because of the general decrease in accumulation rates. The decrease has been such that only two pump outs of the Cell 2 LDS primary containment vessel occurred in the first quarter of 2000. Figure 2-4 also provides the weekly precipitation amounts corresponding to each accumulation period. The precipitation data were added in an effort to determine if a correlation exists between precipitation and the LDS accumulation rate.

Based on review of Figure 2-4, it appears that during January and February, there is a correlation between precipitation and the Cell 2 LDS accumulation rates. During January and February, the Cell 2 LDS accumulation rates appeared to increase concurrently with or just after the rainfall event, whereas for Cell 1, the LDS accumulation rates seemed to increase a week or two after the rainfall events in February and March. Based on the first quarter LDS accumulation rates for Cells 1 and 2, it appears that the length of the time lag between rainfall events and increases in LDS accumulation rates reflect the amount of fill material in a cell. This is expected because as a cell becomes filled, leachate flow is reduced and buffered because it has to percolate through the fill (Cell 1). In new cells (Cells 2 and 3), the leachate flow comes into contact with the top liner much more quickly, and therefore, has more potential to create a pressure/hydraulic head on the liner. This is particularly the case prior to filling a cell's one-acre impacted runoff catchment area located in the southwest corner of each cell. Prior to that time, impounded runoff that exceeds the LCS piping capacity will induce a hydraulic head in the area. Once filled, the slower percolation of water through the waste will help to allow the piping system to more readily handle the inflow and reduce the hydraulic head in the catchment area. As the waste becomes thicker, the percolation rate continues to decrease further and the potential for hydraulic head will continue to decrease.

Finally, after a cell is capped, the potential for such a head to occur will become remote. Weekly LDS accumulation rates for Cell 2 will continue to be compared to precipitation in future IEMP quarterly status reports to determine if the correlation that was evident in January and February 2000 continues.

The accumulation rates for the first quarter ranged from -0.01 gpad to 0.50 gpad with an average of 0.30 gpad. As discussed in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1999 (DOE 2000b), negative accumulation rates are being attributed to evaporation rates being greater than accumulation rates. The first quarter average is higher than the fourth quarter 1999 maximum of 0.172 gpad but still far below the third quarter 1999 average of 3.8 gpad. The first quarter average LDS yield equates to about 3 pints per acre per day. The ongoing accumulation rate measurements indicate that the liner system for Cell 2 continues to perform such that the accumulation rates are far below (quarterly average is nearly two orders of magnitude below) the on-site disposal facility design-established initial response leakage rate of 20 gpad.

2.2.2 CELL 2 ANALYTICAL STATUS

The most recent data (fourth quarter 1999) were reported through the 1999 Integrated Site Environmental Report submitted to EPA and OEPA on June 1, 2000.

2.3 CELL 3

Due to the winter shutdown, March was the only month during the quarter when waste was placed in Cell 3. At the end of March, Cell 3 was approximately 11 percent full.

2.3.1 CELL 3 LEAK DETECTION SYSTEM VOLUMES

No water accumulated in the Cell 3 LDS primary containment vessel during the first quarter of 2000; therefore, the water accumulation rates for the entire quarter are zero.

2.3.2 CELL 3 ANALYTICAL STATUS

The most recent data (fourth quarter 1999) were reported through the 1999 Integrated Site Environmental Report submitted to EPA and OEPA on June 1, 2000.

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2.4 CELL 4

2.4.1 CELL 4 ANALYTICAL STATUS

Baseline sampling of Monitoring Wells 2421 and 22205 is scheduled to begin the summer of 2000.

2.5 LEACHATE COLLECTION SYSTEM VOLUMES

Volumes from the LCS for the first quarter of 2000 are as follows: January (1,816,682 gallons); February (2,129,386 gallons); and March (1,131,210 gallons).

FIGURE 2-1

ON-SITE DISPOSAL FACILITY LEAK DETECTION ACTIVITIES

LEAK DETECTION ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Cell 1												
LDS Volumes	◆	◆	◆	☒	☒	☒						
Analytical	☒	☒	☒									
Cell 2												
LDS Volumes	◆	◆	◆	☒	☒	☒						
Analytical	☒	☒	☒									
Cell 3												
LDS Volumes	◆	◆	◆	☒	☒	☒						
Analytical	☒	☒	☒									
LCS Volumes	●	◆	◆	☒	☒	☒						

● Data summarized/evaluated in this report
☒ Data summarized/evaluated in the next report

FINAL

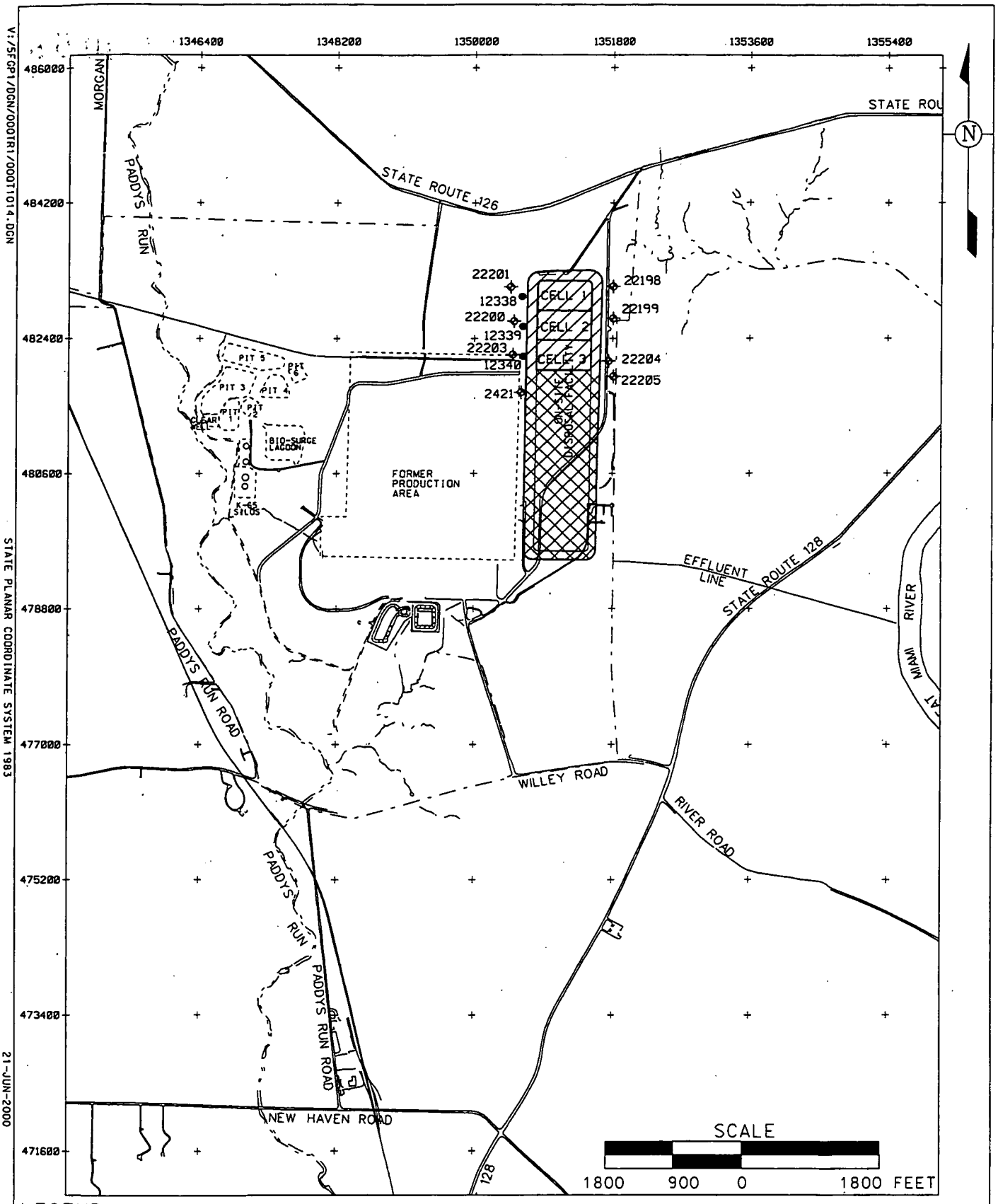
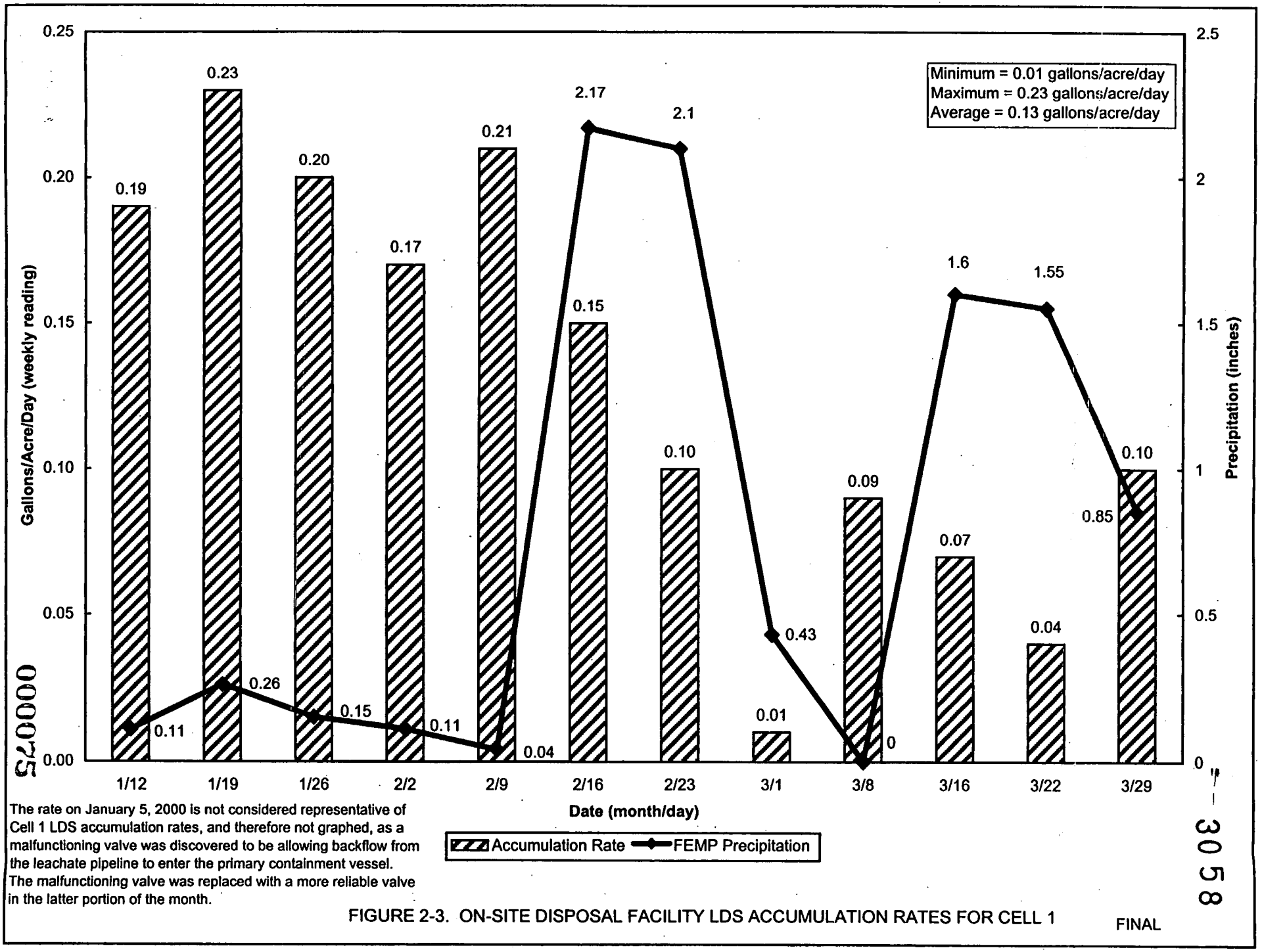


FIGURE 2-2. ON-SITE DISPOSAL FACILITY FOOTPRINT AND MONITORING WELL LOCATIONS



The rate on January 5, 2000 is not considered representative of Cell 1 LDS accumulation rates, and therefore not graphed, as a malfunctioning valve was discovered to be allowing backflow from the leachate pipeline to enter the primary containment vessel. The malfunctioning valve was replaced with a more reliable valve in the latter portion of the month.

FIGURE 2-3. ON-SITE DISPOSAL FACILITY LDS ACCUMULATION RATES FOR CELL 1

FINAL

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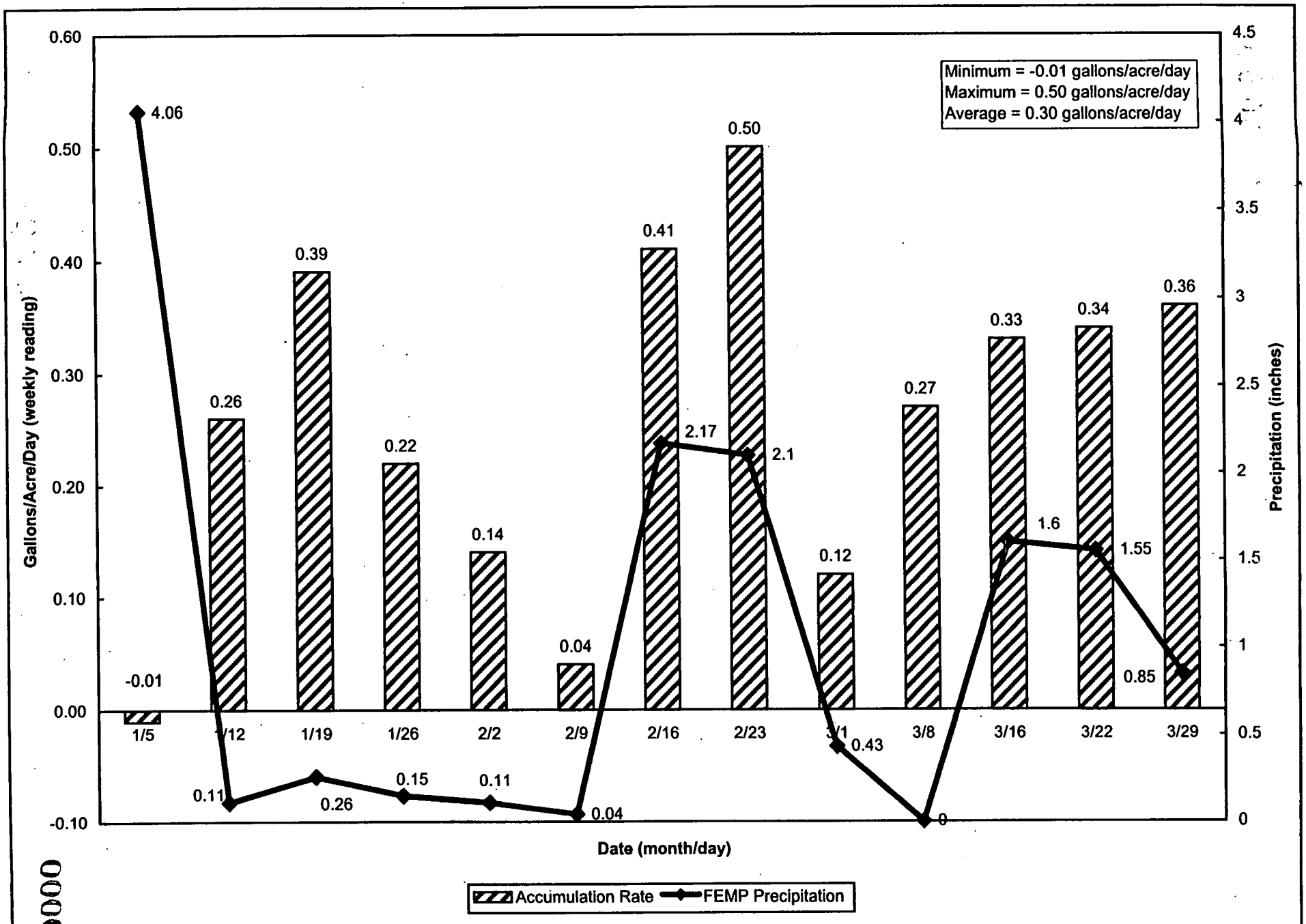

FIGURE 2-4. ON-SITE DISPOSAL FACILITY LDS ACCUMULATION RATES FOR CELL 2 FINAL

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Surface Water and Treated Effluent

3.0 SURFACE WATER AND TREATED EFFLUENT

This section provides a status of the surface water and treated effluent monitoring for the first quarter of 2000. Figure 3-1 shows the data included in this section. Figure 3-2 identifies the surface water and treated effluent sample locations. Analytical results from the following routine monitoring program elements were utilized to complete the reporting requirements identified in Section 4.6.2 of the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a):

- National Pollutant Discharge Elimination System (NPDES) permit (data obtained from January through March 2000)
- Federal Facilities Compliance Agreement (FFCA) requirements (data obtained from January through March 2000).

IEMP Characterization Program results (data obtained from October through December 1999) were presented in the 1999 Integrated Site Environmental Report (DOE 2000a) and are not presented in this quarterly status report.

Figure 3-1 also shows the data from the surface water and treated effluent sampling activities that will be included in the next IEMP quarterly status report to be submitted in September of 2000. The report will contain NPDES and FFCA data from April through June 2000 (second quarter) and analytical data from the IEMP Characterization Program from January through March 2000 (first quarter).

3.1 NPDES PERMIT COMPLIANCE

The new NPDES Permit became effective March 1, 2000. This permit (1IO00004*FD) significantly expands the sampling frequency and constituents sampled at the Parshall Flume (PF 4001) and adds two new monitoring points (4801 and 4902) representing ambient monitoring points within the Great Miami River upstream and downstream of Fernald site effluent. Note that point 4801 is the same location as SWR-01, and will be referred to as SWR-01; and that point 4902 will be preceded by the "SWR-" prefix in order to identify it as a river location (e.g., SWR-4902). Figure 3-3 identifies these locations.

Sampling frequencies at the five storm water outfalls to Paddys Run (SWRB 4002O, STRM 4003, STRM 4004, STRM 4005, and STRM 4006) remain the same, with a reduction in constituents sampled. The sampling frequency of the sewage treatment plant effluent (STP 4601) also remains the same, except that the biannual sampling of metals has been eliminated. Also, the sewage sludge monitoring point (4589) has been eliminated from the renewed permit. The data associated with NPDES will continue to be reported in the IEMP quarterly status reports, including the modifications associated with the new permit. The modifications associated with the new NPDES Permit will be incorporated into the new IEMP, Revision 2, which will be completed later in 2000.

Figure 3-3 identifies the surface water and treated effluent sample locations associated with NPDES compliance monitoring. Wastewater and storm water discharges from the Fernald site were in compliance 100 percent of the time during January and February 2000 (under the old permit). However, the Fernald site experienced four noncompliances in March 2000. Two of these were related to total suspended solids concentration at the sewage treatment plant (daily maximum and monthly average). These noncompliances were related to difficulties in controlling total suspended solids in the sewage treatment process. Further explanation is provided in the noncompliance report that was provided to the Ohio Environmental Protection Agency (OEPA) (reference Letter No. C:SWP(ARWWP):2000-0009, dated April 17, 2000).

The other two noncompliances involved exceeding the daily maximum mass loading of oil and grease at the Parshall Flume on March 17 and 22. However, the concentrations for oil and grease on these days were within effluent limitations. There is no definitive cause for the slightly elevated oil and grease concentrations experienced on these days, though this will be evaluated further should noncompliances continue to be identified.

These noncompliances were reported to OEPA pursuant to the conditions of the NPDES Permit.

3.2 FFCA AND OU5 ROD COMPLIANCE

Figure 3-4 shows that a cumulative total of 71.5 pounds of uranium were discharged to the Great Miami River in effluent from January through March 2000. The Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996) established an annual discharge limit to the Great Miami River of 600 pounds for total uranium.

Uncontrolled runoff also contributes to the amount of total uranium entering the environment. A loading term has been established to estimate the amount of uranium discharged through uncontrolled runoff based on the amount of rainfall measured. The loading term used is 2.6 pounds of uranium discharged per inch of rainfall. Figure 6-1 shows that precipitation during the first quarter of 2000 was 13.53 inches; therefore, the mass of total uranium discharged to Paddys Run through uncontrolled runoff from January through March 2000 is estimated to be 35.18 pounds. In addition, there was an overflow at the Storm Water Retention Basin in January (Table 3-1) due to the rainfall event of January 3, 2000. This rainfall event was intense enough that an overflow could not be avoided even with bypassing initiated. The result from the uranium sample collected during this overflow was 253.2 micrograms per liter (μg/L). Based on an estimated overflow volume of 4,041,180 gallons, the total estimated amount of uranium that overflowed to Paddys Run was 8.53 pounds. Therefore, the total amount of uranium discharged from uncontrolled runoff during the first quarter of 2000, including both the loading term and the Storm Water Retention Basin overflow, was 43.71 pounds.

Figure 3-5 illustrates that the monthly average total uranium concentration limit of 20 μg/L for water discharged to the Great Miami River was met each month during the first quarter of 2000. Table 3-1 indicates there were two treatment plant bypass events associated with significant precipitation that occurred during the first quarter of 2000. The Operable Unit 5 Record of Decision allows the Fernald site to bypass up to 10 days to accommodate those periods where treatment system capacity is exceeded due to heavy or sequential rainfall events. The days associated with bypass events are counted according to the definitions provided in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project (DOE 1999b).

Figure 3-6 presents controlled and uncontrolled surface water flow areas for the first quarter of 2000. As identified in previous IEMP quarterly status reports, an evaluation of controlled areas is to occur at least quarterly in order to help ensure that the appropriate areas are being controlled. There were no changes from that depicted in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1999 (DOE 2000b).

3.3 SURVEILLANCE MONITORING

The following activities occurred during the first quarter of 2000 that could have potentially impacted the water quality at various surface water sample locations (identified in parentheses):

- Limited activities in the on-site disposal facility borrow area (SWD-02 and STRM 4003)
- Construction activities associated with on-site disposal facility Cell 3 (SWD-02 and STRM 4003) and initiation of placement of impacted materials into Cell 3 (PF 4001).
- Stabilization activities (seeding) and construction completion activities in Area 1, Phase II (SWD-02, STRM 4003, and PF 4001)
- Excavation of southern waste unit material and hauling of excavated materials to the on-site disposal facility via the impacted material haul road (STRM 4004, STRM 4005, and PF 4001)
- Construction activities associated with South Field Extraction Wells 32446 and 32447 in the South Field area (STRM 4003)
- Initiation of full scale operations, excavation of materials from Waste Pits 3 and 5, and general waste pit area activities in support of the Waste Pits Remedial Action Project (WPRAP) (PF 4001)
- Loading of contaminated material in support of the WPRAP activities (STRM 4005, PF 4001, SWD-03, and SWP-02)
- Rail yard activities in support of the loading and shipping of trains (STRM 4006 and SWP-02)
- Construction activities associated with the Area 8, Phase II Natural Resource Restoration project (SWP-02).

All samples from the surface water and treated effluent locations were collected during the first quarter, except for the January monthly total uranium sample at SWD-02 and SWD-03. This issue was communicated to the project and corrected during the subsequent months. As identified in the 1999 Integrated Site Environmental Report, various efforts have been initiated in order to improve sample collection efforts.

Based on a review of the surface water data associated with this report (Figure 3-1), the activities listed in the bullet points above have not caused any final remediation level (FRL) or benchmark toxicity value exceedances in uncontrolled surface water or treated effluent. However, there was a FRL exceedance (Table 3-2) identified at the Storm Water Retention Basin overflow (SWRB 4002O) during the first quarter of 2000. The exceedance was a copper result of 0.016 milligrams per liter (mg/L) that exceeded the surface water FRL of 0.012 mg/L. These data will continue to be evaluated in light of ongoing remediation activities to assess potential impacts to the surface water pathway.

As identified in the 1999 Integrated Site Environmental Report, pre-design groundwater characterization activities in the waste storage and Plant 6 areas confirmed that an area in the Pilot Plant Drainage Ditch adjacent to Paddys Run should be

considered as a primary source of infiltration, and therefore, a cross-media impact to the underlying aquifer. Therefore, STRM 4005 (the IEMP and NPDES monitoring point immediately upstream of this point of confluence) and SWD-03 will also be evaluated and discussed with respect to cross-media impacts to the groundwater pathway. Graphs displaying total uranium concentrations through 1999 at STRM 4005 and SWD-03 are provided as Figure 3-7 and Figure 3-8, respectively, in order to evaluate recent cross-media impacts. As identified on these graphs, there were exceedances of the total uranium FRL for groundwater (20 μg/L) at these locations, which could be contributing to the uranium in the aquifer identified on Figure 1-32 of this report. Future discussions on cross-media impacts will be provided annually in the integrated site environmental reports as consistent with reporting requirements.

TABLE 3-1

2000 STORM WATER RETENTION BASIN OVERFLOWS AND TREATMENT BYPASS EVENTS

Event	Duration (hours)	Number of Bypass Days[a]	Cumulative Number of Bypass Days	Total Uranium Discharged (pounds)	Total Water Discharged (millions of gallons)
Overflows				(to Paddys Run)	(to Paddys Run)
January 4	16.16	1	1	8.53	4.041
Significant Precipitation Bypasses				(to Great Miami River)	(to Great Miami River)
January 3 through January 5	39.67	1	1	4.19	2.455
February 18 through February 19	30.50	1	2	5.87	2.064

[a]Days are counted according to the definition provided in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project.

TABLE 3-2

SURFACE WATER LOCATIONS WITH RESULTS ABOVE THE FRL, INCLUDING SUMMARY STATISTICS

Sample Location	Constituent	Total Number of Samples Since January 1, 1997[a,b,c]	Number of Samples with FRL Exceedances Since January 1, 1997[a,b,c]	Number of Samples with FRL Exceedances for First Quarter 2000[a,b,c]	FRL[d] (mg/L)	Summary Statistics[b,e,f] Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	Results with FRL Exceedances for First Quarter 2000 Sample Result (mg/L)	Validation Qualifier[g]	Sample Date
SWRB 4002O (Storm Water Retention Basin Overflow)	Copper	4	3	1	0.012	0.0116	0.016	0.014	0.016	NV	01/03/00

[a]Total number of samples is from all programs including NPDES, NPDES Permit renewal, FFCA, and IEMP Characterization Program.
[b]If more than one sample is collected per surface water location per day (e.g., duplicate, grab, composite), then only one sample is counted for the total number of samples and the sample with the maximum concentration is used for the summary statistics and in determining FRL exceedances.
[c]Rejected data qualified with either a R or Z were not used for this table.
[d]From Operable Unit 5 Record of Decision , Table 9-5
[e]If the total number of samples is greater than or equal to three, then the minimum, maximum, and average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then none of the summary statistics are reported.
[f]For results where the concentrations are below the detection limit, the results used in the summary statistics are each set at half the detection limit.
[g]Validation qualifier codes are provided in Appendix D of the Sitewide CERCLA Quality Assurance Project Plan (DOE 1998).

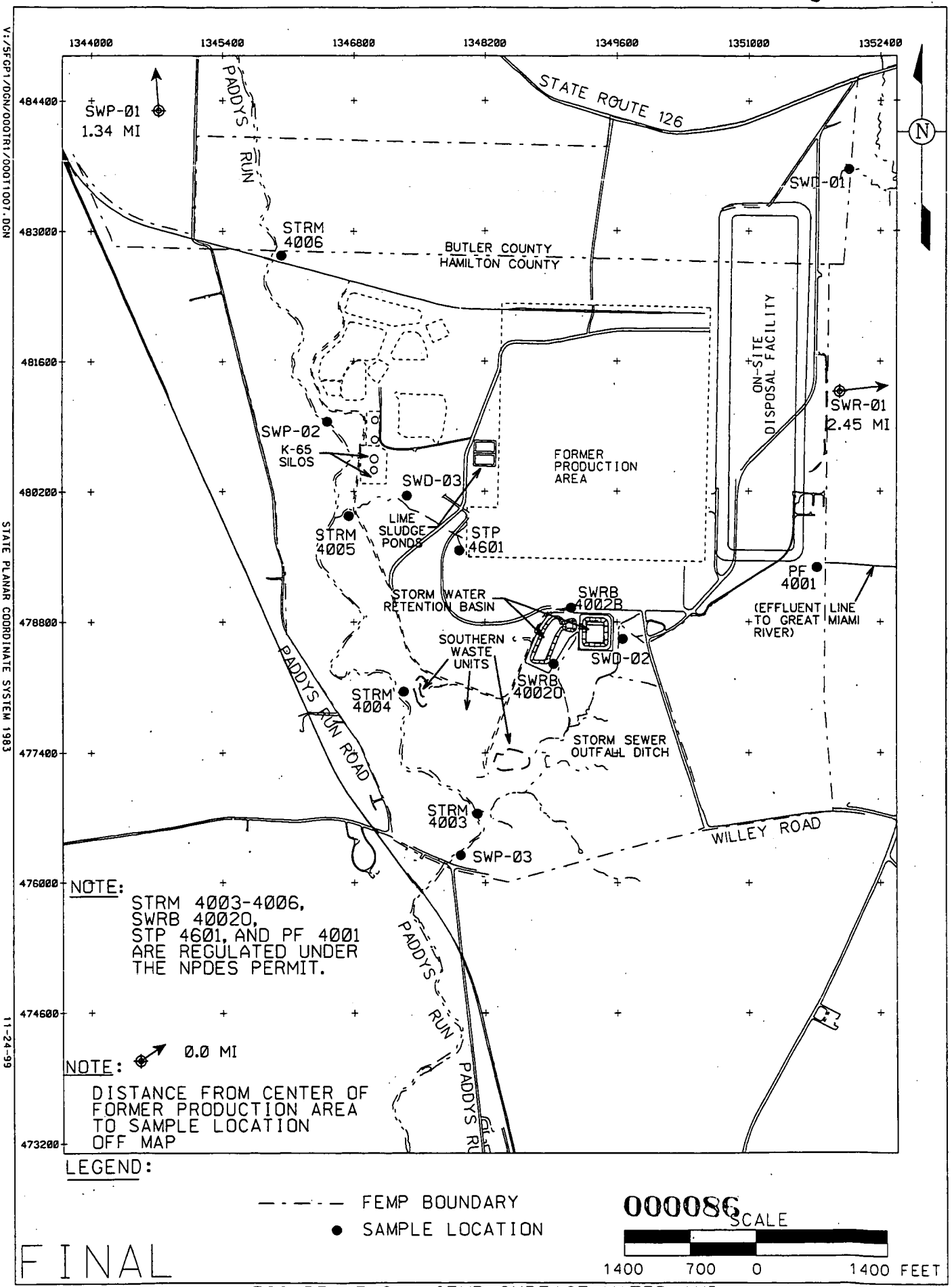
FIGURE 3-1

SURFACE WATER AND TREATED EFFLUENT SAMPLING ACTIVITIES

SAMPLING ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NPDES	◆	◆	◆	☒	☒	☒						
FFCA	◆	◆	●	☒	☒	☒						
IEMP Characterization	☒	☒	☒									

◆ Data summarized/evaluated in this report
☒ Data summarized/evaluated in the next report

FINAL



000086

FIGURE 3-2. IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

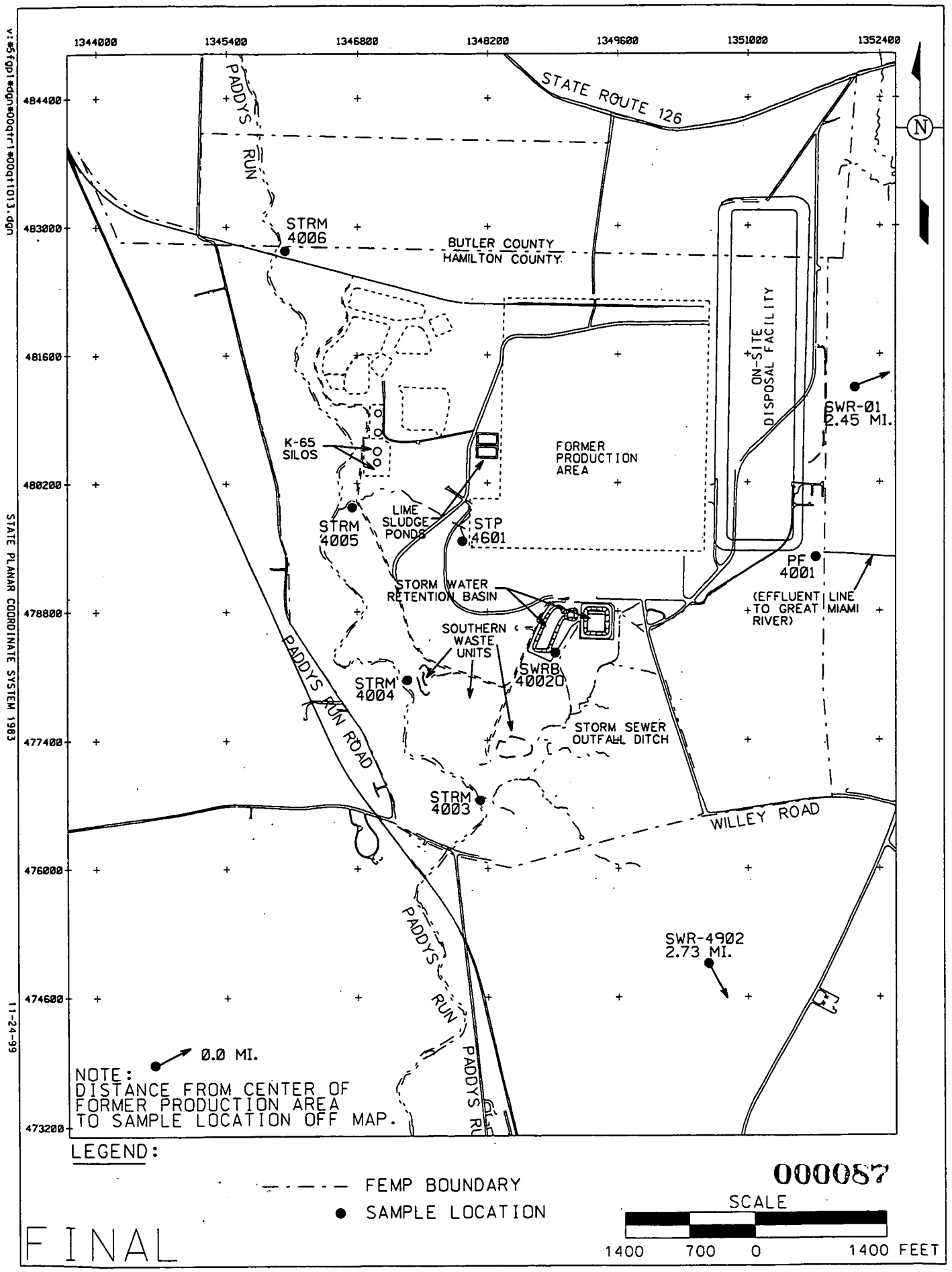


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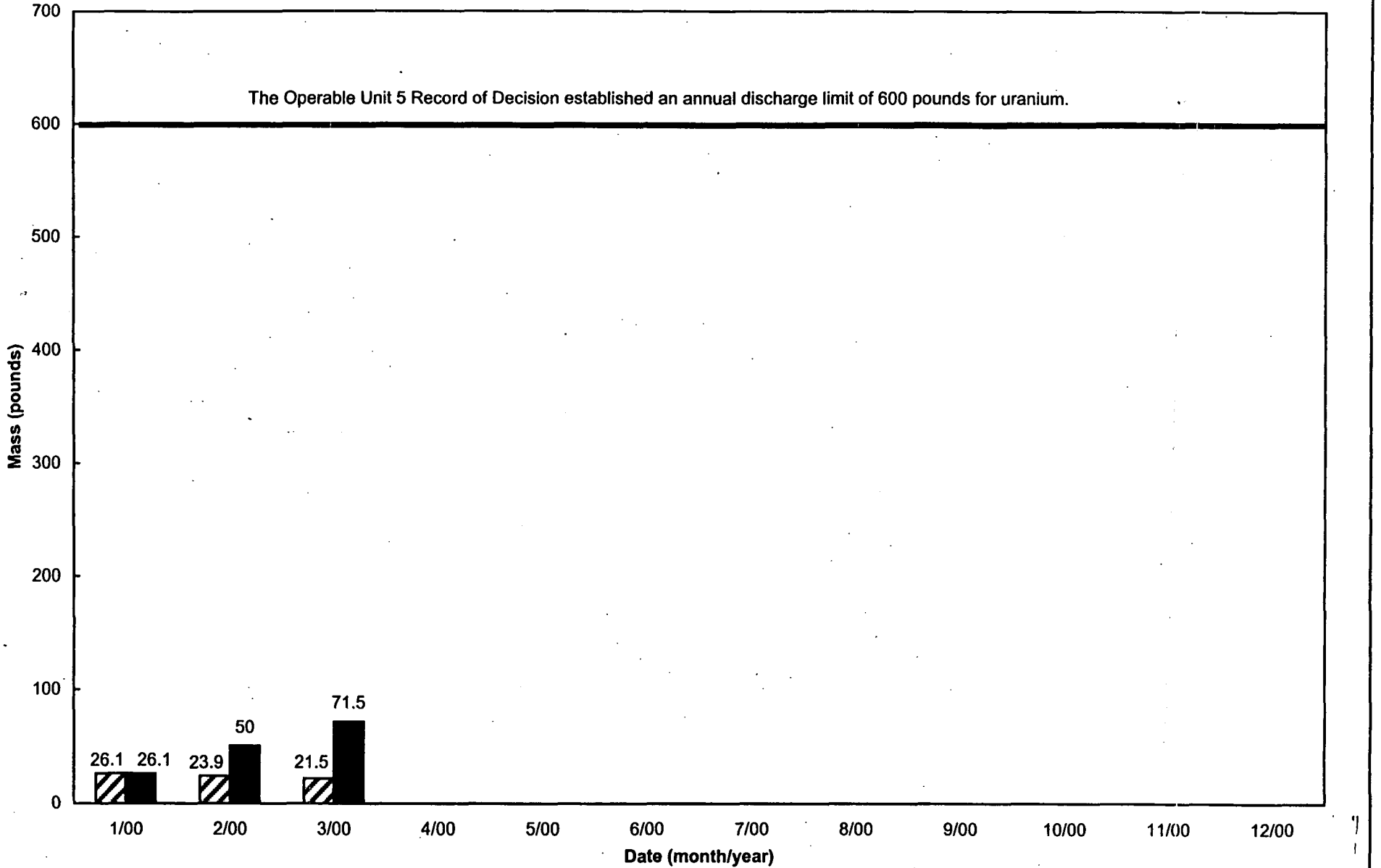
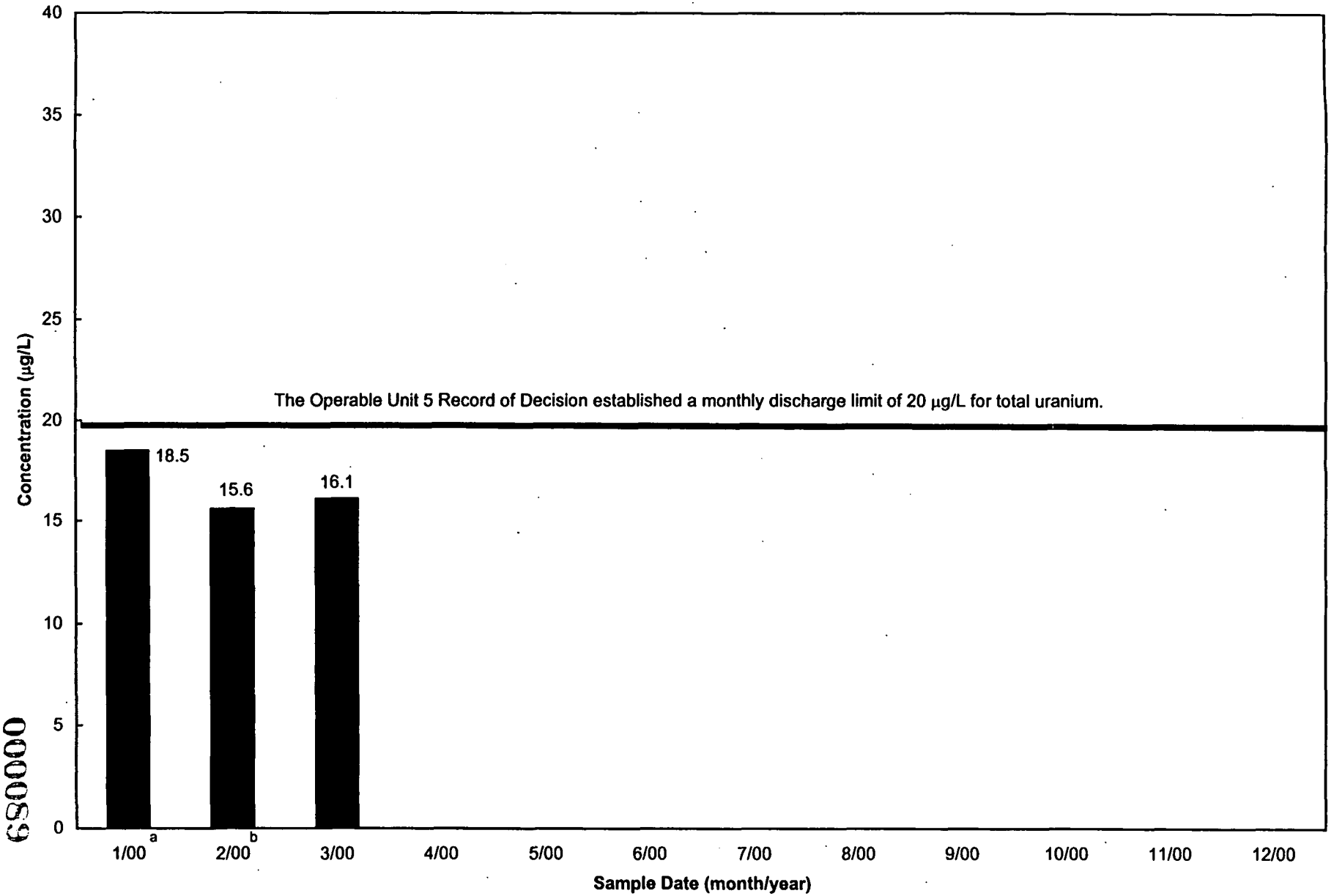
FIGURE 3-3. NPDES PERMIT SAMPLE LOCATIONS



Note: Sum of monthly discharges may not always agree with cumulative total due to rounding differences.

FIGURE 3-4. POUNDS OF URANIUM DISCHARGED TO THE GREAT MIAMI RIVER FROM THE PARSHALL FLUME (PF 4001) IN 2000

FINAL

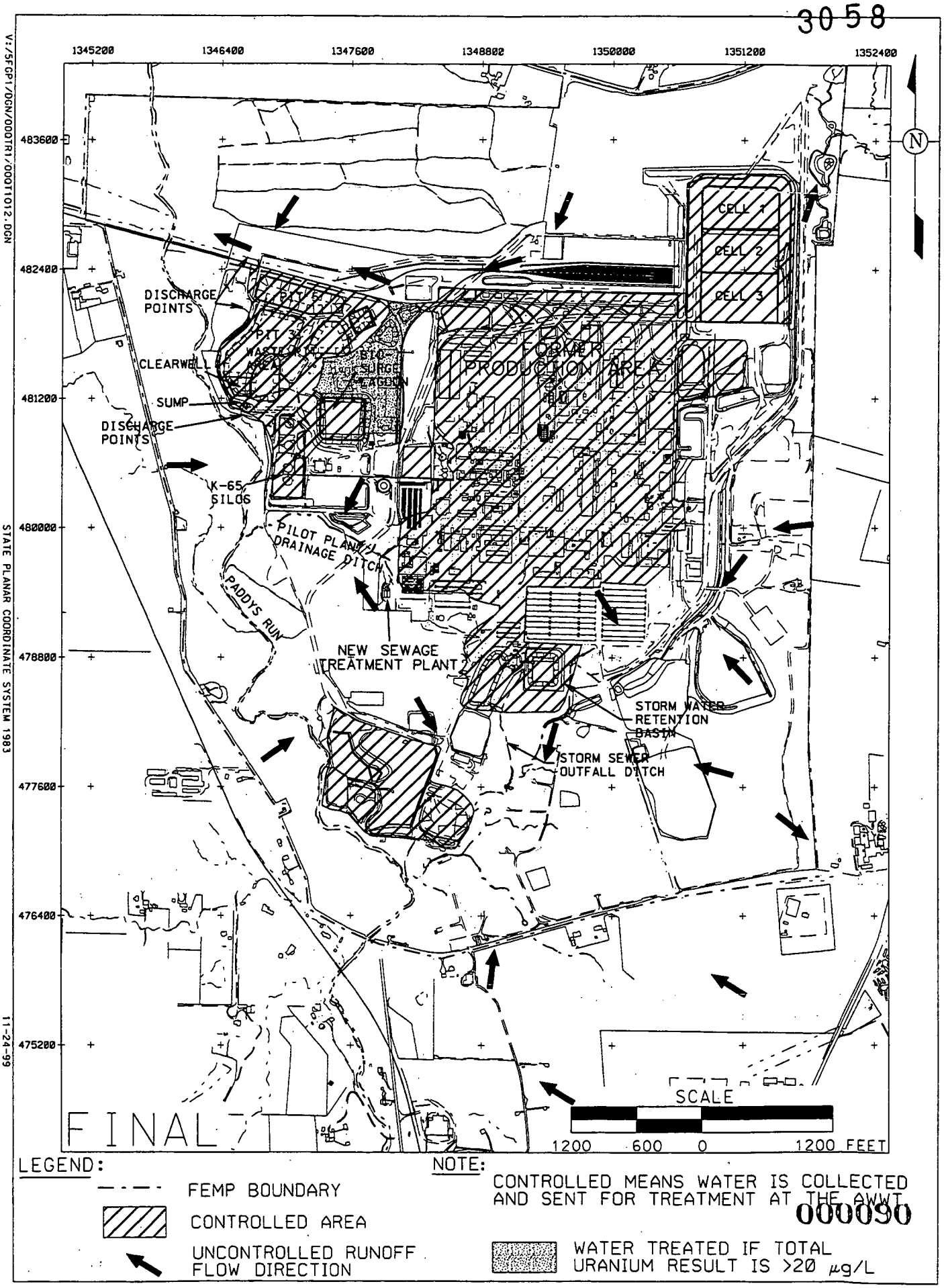


[a]Actual concentration was 20.9 µg/L. Eliminating one "significant precipitation" bypass day reduces average to 18.5 µg/L.

[b]Actual concentration was 18.7 µg/L. Eliminating one "significant precipitation" bypass day reduces average to 15.6 µg/L.

FIGURE 3-5. 2000 MONTHLY AVERAGE TOTAL URANIUM CONCENTRATION IN WATER DISCHARGED FROM THE PARSHALL FLUME (PF 4001) TO THE GREAT MIAMI RIVER

FINAL



LEGEND:

- FEMP BOUNDARY
- CONTROLLED AREA
- UNCONTROLLED RUNOFF FLOW DIRECTION
- WATER TREATED IF TOTAL URANIUM RESULT IS >20 µg/L

NOTE:

CONTROLLED MEANS WATER IS COLLECTED AND SENT FOR TREATMENT AT THE AWWT.

FIGURE 3-6. CONTROLLED SURFACE WATER AREAS AND UNCONTROLLED FLOW DIRECTIONS FOR FIRST QUARTER 2000

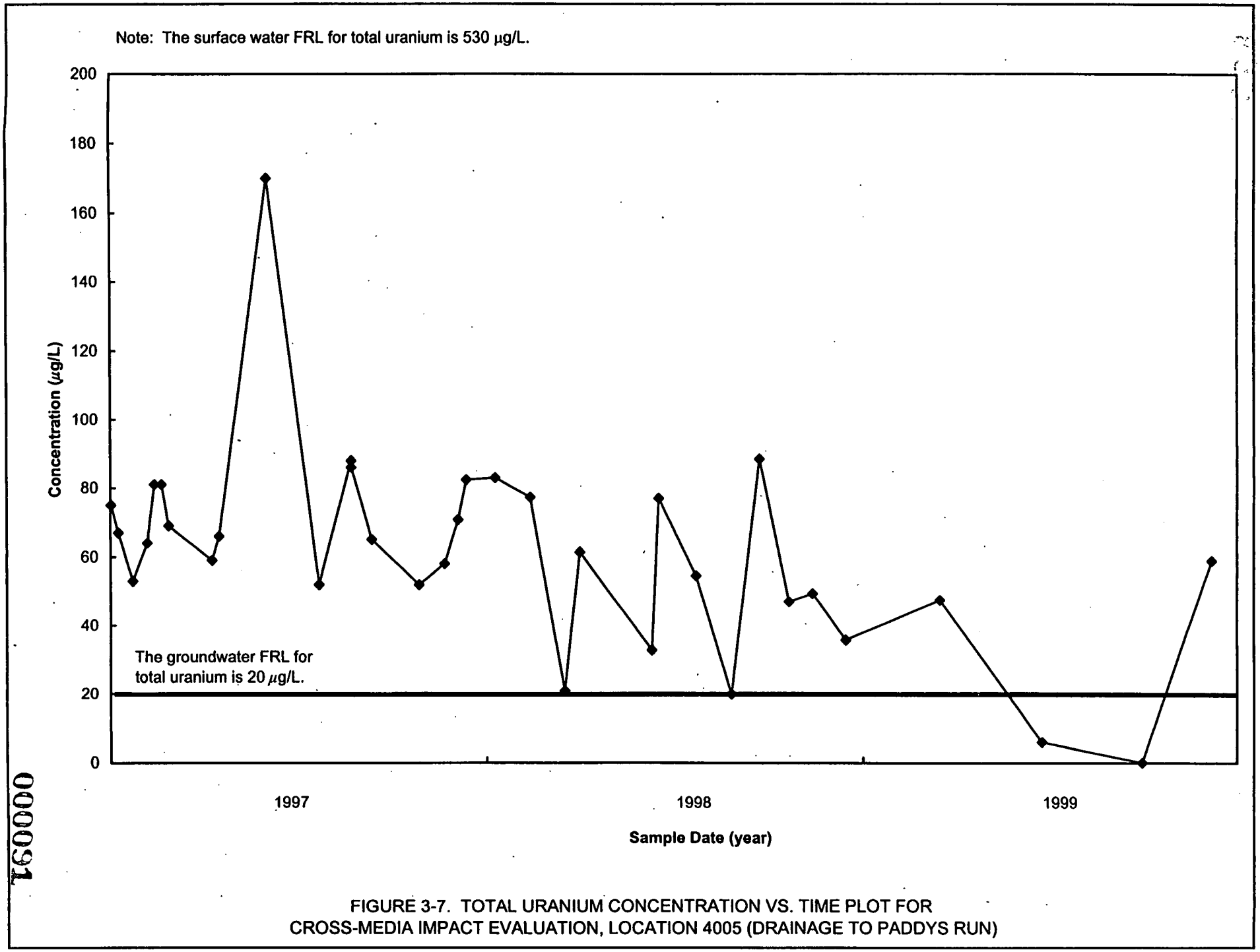


FIGURE 3-7. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR CROSS-MEDIA IMPACT EVALUATION, LOCATION 4005 (DRAINAGE TO PADDYS RUN)

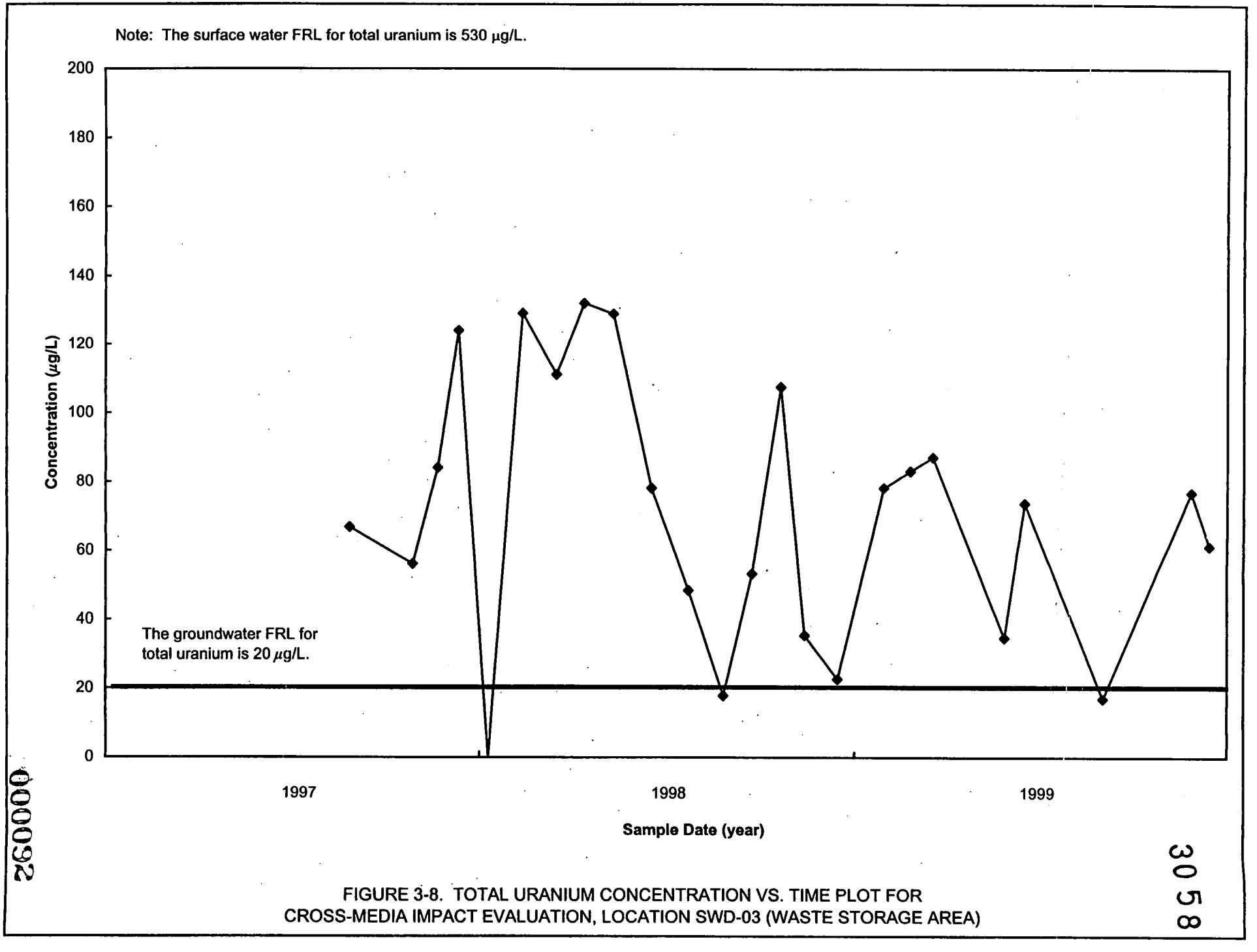


FIGURE 3-8. TOTAL URANIUM CONCENTRATION VS. TIME PLOT FOR
CROSS-MEDIA IMPACT EVALUATION, LOCATION SWD-03 (WASTE STORAGE AREA)

Air Monitoring

4.0 AIR MONITORING

This section provides a summary of the first quarter 2000 monitoring activities and analytical results for the Integrated Environmental Monitoring Plan (IEMP) air monitoring program. Figure 4-1 shows the data included in this section. Analytical results from the following routine air monitoring program elements and project-specific air monitoring activities covered in this section include:

- Radiological Air Particulate Monitoring:
  - National Emissions Standards for Hazardous Air Pollutants (NESHAP) Compliance
  - Monitoring Thorium Emissions from the Waste Pits Remedial Action Project (WPRAP)
- NESHAP Stack Emissions Monitoring
- Radon Monitoring:
  - Continuous Alpha Scintillation Monitoring - Silo Head Space and Environmental Data
- Direct Radiation Monitoring (via thermoluminescent dosimeters [TLDs]).

Figure 4-1 also shows the data from the air monitoring activities that will be included in the next IEMP quarterly status report to be submitted in September of 2000. The report will contain data from air monitoring activities from April through June 2000 (second quarter). Monitoring activities defined under the IEMP for radiological particulate, stack, radon, and direct radiation monitoring will continue as planned during the second quarter of 2000.

4.1 RADIOLOGICAL AIR PARTICULATE MONITORING

4.1.1 TOTAL URANIUM, TOTAL PARTICULATE AND THORIUM

The average first quarter 2000 airborne uranium particulate concentrations were less than or equal to the average fourth quarter 1999 concentrations at 13 of the 16 fenceline air particulate monitoring locations. The general decrease in first quarter averages reflects the shutdown of most earthmoving remediation projects during the winter months. At three stations (AMS-4, AMS-9C, and AMS-22) increases in the quarterly average concentrations were observed. These increases parallel the increases in biweekly airborne uranium particulate concentrations that occurred late in the first quarter. With the onset of warmer weather and the resumption of earthmoving remediation projects, biweekly airborne uranium particulate concentrations increased at several fenceline monitoring locations at the end of the first quarter, particularly along the eastern fenceline.

Figure 4-2 identifies the location of the air monitoring stations. Table 4-1 provides a summary of first quarter 2000 and historical total uranium concentrations. First quarter and historical total uranium concentration graphs for each location can be viewed by going to Table 4-1 and selecting the appropriate location. Table 4-2 provides a summary of first quarter and historical total particulate concentrations. First quarter and historical total particulate concentration graphs for each location can be viewed by going to Table 4-2 and selecting the appropriate location. As indicated by the graphs, particulate concentrations at fenceline and background locations during the first quarter of 2000 are lower, yet comparable to fourth quarter 1999 particulate concentrations. The lower first quarter 2000 total particulate concentrations reflect the shutdown of most earthmoving remediation projects and higher soil moisture conditions during the winter months.

The waste pit monitors (refer to Figure 4-2 for WPTH-1 and WPTH-2 locations) were installed to address potential increases in airborne thorium concentrations, specifically thorium-230, that may result from fugitive emissions from the excavation of the waste pits. First quarter thorium-230 concentrations measured at WPTH-1 and WPTH-2 (refer to Figure 4-21 and Figure 4-22, respectively) reflect the continuing excavation of Waste Pit 3 and the associated material handling operations associated with WPRAP. Early in the first quarter, there was a notable increase in the thorium-230 concentration measured at the WPTH-2 location (refer to Figure 4-22). The increase was short-lived and thorium-230 levels returned to more typical of the levels measured since the start of WPRAP in the following sampling periods. The temporary increase was attributed to fugitive emissions from handling the waste material. Thorium concentrations at WPTH-1 and WPTH-2 will continue to be monitored biweekly in order to assess the impact of emissions resulting from excavation of the waste pits and material handling associated with WPRAP dryer operations. As a result of elevated thorium-230 concentrations, WPRAP is reviewing their operations and facilities in an effort to reduce the fugitive emissions from the excavation, transport, and handling of the waste pit materials.

Figure 4-23 and Figure 4-24 show historical concentration versus time plots of thorium-228 and thorium-232 at WPTH-1 and WPTH-2, respectively. As indicated by the plots, the airborne concentrations of thorium-228 and thorium-232 at the monitors are comparable to background and have generally remained consistent throughout the first quarter. These fenceline data reflect the fact that the concentrations of thorium-228 and thorium-232 in the waste pit material are relatively low in comparison to concentrations of thorium-230, which is in the uranium-238 decay chain. WPRAP operations are not expected to significantly impact the fenceline concentrations of thorium-228 and thorium-232.

4.1.2 NESHAP COMPLIANCE

The maximum first quarter 2000 dose equivalent, calculated from first quarter air composite data, was 0.37 millirem (mrem) and occurred at AMS-3. This represents 3.7 percent of the annual 10 mrem NESHAP Subpart H standard. The maximum first quarter 2000 dose represents a significant increase over the first quarter 1999 dose of 0.018 mrem. The increase reflects the continuation of WPRAP activities during the first quarter of 2000. WPRAP excavation activities were not conducted during the first quarter of 1999. Table 4-3 contains the first quarter doses for each air monitoring station and the fractional contribution of each radionuclide to the total dose.

On average, isotopes of thorium contributed approximately 65 percent of the dose at the fenceline air monitoring stations during the first quarter of 2000. In particular, thorium-230 contributed 58 percent of the dose at the fenceline air monitoring stations. On average, uranium and radium-226 contributed approximately 16 percent and 17 percent, respectively, of the doses at the fenceline air monitoring stations. These relative contributions to the fenceline dose equivalent are notably different than historical dose contribution data, which indicate uranium typically contributes greater than 62 percent of the dose based on an evaluation of fenceline monitoring results from 1990 to 1998. The increase in the percentage of dose from thorium, specifically thorium-230, is attributed to emissions from the excavations and subsequent material handling associated with WPRAP.

As a result of elevated thorium-230 concentrations, WPRAP is reviewing their operations and facilities in an effort to reduce the fugitive emissions from the excavation, transport, and handling of the waste pit materials. Furthermore, as a result of the increase in percentage of dose from thorium and in accordance with the data evaluation process described in the IEMP, modifications to the IEMP air monitoring and analytical schedule are being evaluated to better monitor this change in the major contributor to air inhalation dose.

NESHAP STACK EMISSIONS MONITORING

Table 4-4 includes the NESHAP stack emissions monitoring results and Figure 4-25 shows the NESHAP stack emissions monitoring locations. First quarter 2000 results for the Laundry and Building 71 stacks are within expected ranges. Typically, post production (1991 to present) stack monitoring results are near or below the minimum detectable concentration (MDC) levels for all isotopes monitored. The laundry stack monitoring was discontinued on February 2, 2000, due to suspension of laundry operations. No other significant changes in the source operations associated with either stack were noted during the first quarter.

The WPRAP dryer stack began operations late in the fourth quarter of 1999. First quarter 2000 results also indicate levels near or below MDC levels for all isotopes, excluding radon. The WPRAP dryer stack contains a continuous radon (i.e., radon-220 and radon-222) monitor. During dryer operations, the maximum daily release of radon (radon-220 and

radon-222) from the dryer stack was 6,912 μCi, which is below the estimated maximum hourly release rate of 13,000 μCi/hr for radon-222. Although radon stack monitoring is not required per the NESHAP Subpart H regulations, Table 4-4 includes a summary of the results from the stack radon monitor.

4.2 RADON MONITORING

4.2.1 ENVIRONMENTAL RADON

Environmental radon concentrations are strongly influenced by seasonal meteorological conditions and patterns. Meteorological conditions known as inversions have the largest influence on radon concentrations. During an inversion, a layer of stable, cooler air is trapped near the earth's surface by an upper layer of warmer air. There is relatively little circulation and mixing within this layer of cooler air and, as a result, the radon emitted from both the soil and the K-65 Silos increases in this layer. Inversions are classified based on the gradient, or rate of increase, in air temperature with increasing elevation. Since the strongest inversions (i.e., the largest temperature gradients) are experienced in the early morning hours and are more prevalent during the first and fourth quarters, maximum radon concentrations can be expected to occur during these times of the year. Table 4-5 summarizes first quarter 2000 and historical environmental radon data from continuous monitors. First quarter 2000 average radon concentrations at all boundary locations (refer to Figure 4-26) were below the 3 picoCuries per liter (pCi/L) above background annual average radon concentration limit.

As expected, the highest continuous environmental radon monitoring results were recorded at the K-65 exclusion fence. Prior to re-sealing the silo domes, there had been a gradual increase in radon levels recorded at the K-65 exclusion fence corresponding to increasing radon concentrations within the two K-65 Silos. Following the re-sealing of the silo domes (completed on June 4, 1999), radon data from the K-65 Silo area has been closely monitored in order to gauge the effectiveness in reducing radon emissions. In general, first quarter 2000 radon levels at the four K-65 exclusion fence monitors are lower than during the same monthly periods in 1999. Comparing the first quarter 1999 and first quarter 2000 average radon concentrations at the KNE and KSE exclusion fence monitors (chosen because of prevailing wind directions) provides some measure of the effectiveness of the re-sealing activities. The first quarter 2000 combined average radon concentration for the KNE and KSE monitors was approximately 74 percent lower than the first quarter 1999 average, suggesting the re-sealing effort contributed to a substantial reduction in radon concentrations at the K-65 Silo area.

During the first quarter of 2000, there was one exceedance of the U.S. Department of Energy (DOE) Order 5400.5 100 pCi/L radon limit. For comparison, there were 23 exceedances of the 100 pCi/L radon limit during the first quarter of 1999. The reduction in the number of exceedances during the first quarter 2000 provides additional evidence that the re-sealing effort reduced radon emissions from the silos. Table 4-6 lists the exceedance event with its duration in hours, affected monitoring locations, and the maximum hourly concentration.

4.2.2 SILO HEADSPACE

K-65 Silo headspace radon concentrations fluctuate seasonally due to changes in meteorological parameters (e.g., temperature, barometric pressure, humidity, etc.). To account for the seasonal variations, concentrations are summarized quarterly (from the daily average concentrations) in order to compare data collected under similar meteorological conditions.

As mentioned in the Integrated Environmental Monitoring Status Report for Fourth Quarter 1999 (DOE 2000b), differences were found between K-65 headspace radon concentrations calculated from grab sample measurements and data recorded by the continuous monitoring system. Specifically, the continuous monitoring system has consistently recorded concentrations that are approximately 70 to 80 percent of grab sample measurements. The differences in the calculated radon concentration are due to the equilibrium concentration of the radon daughters within the counting instrument. In a grab sample measurement, radon daughter equilibrium is established prior to counting the sample. In the continuous monitoring system, radon daughter equilibrium is assumed to exist during the measurement process. Results from equilibrium tests performed in 1999 confirmed that radon daughters are not in complete equilibrium within the continuous system and that the equilibrium factors were approximately 0.80 for K-65 Silo 1 and 0.76 for K-65 Silo 2.

Beginning in January 2000, DOE is applying correction factors, as stated in an interoffice memo (reference Memo No. M:SWP(EM):2000-0002, dated January 25, 2000) to account for the non-equilibrium condition encountered when calculating and reporting radon concentrations measured by the continuous monitoring system. Applying the correction factors results in an increase in calculated headspace radon concentrations of at least 20 to 25 percent when compared to the previous quarter. The increase is apparent in Figure 4-27, which trends the average headspace radon concentrations by quarter. It should be noted that the correction factors do not affect ambient environmental radon monitors located on site or at the site fenceline because these monitors employ a different sampling technique and do not rely on the assumption of equilibrium.

Table 4-7 presents average headspace radon concentrations by month, utilizing data from the continuous monitoring system. First quarter 2000 data from each silo reflect the application of the correction factors discussed above. Monthly average radon concentrations for K-65 Silo 1 during the first quarter of 2000 ranged between 16.4 and 18.1 million pCi/L. The quarterly average concentration increased approximately 30 percent over the quarterly average concentration during the same period in 1999. The average concentration for Silo 1 is approximately 66 percent of the pre-bentonite concentration level (~26 million pCi/L). First quarter 2000 monthly average continuous monitoring results for K-65 Silo 2 ranged between 15.6 and 17.5 million pCi/L. The quarterly average concentration increased approximately 75 percent from the average concentration during the same period in 1999. The average concentration for Silo 2 is approximately 55 percent of the pre-bentonite concentration level (~30 million pCi/L).

4.3 DIRECT RADIATION (TLD) MONITORING

All monitoring results from direct radiation measurements for the first quarter of 2000 were within historical ranges. Figure 4-28 depicts the monitoring locations and direct radiation measurements are shown in Table 4-8. As noted in previous IEMP quarterly status reports, a positive trend in the immediate area of the K-65 Silos (locations 22 through 26) has been identified and will continue to be monitored (refer to Figure 4-29). This trend is attributed to a corresponding increase in radon and radon-progeny concentrations observed in the K-65 Silo head space. The increase in direct radiation measurements adjacent to the silos is still well below the levels observed prior to the addition of bentonite to the silos in 1991.

As discussed in previous reports, a slight positive trend in direct radiation measurements at the site fenceline nearest the K-65 Silos (location 6) has been identified. The trend is associated with the increasing direct radiation levels at the K-65 Silos, as discussed above. The upward trend at the site fenceline nearest the K-65 Silos is difficult to measure consistently due to small variations in the sensitivity and accuracy of the environmental TLDs. Figure 4-30 shows the slight positive trend at location 6.

3058

TABLE 4-1

TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR

	First Quarter 2000 Results[a] (pCi/m^2 x 1E-6)				1999 Summary Results[a] (pCi/m^3 x 1E-6)				1990 through 1998 Summary Results[a] (pCi/m^3 x 1E-6)	
Location	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
Fenceline										
AMS-2	7	22	157	75	25	9.5	269	57	0	3500
AMS-3	7	34	287	153	26	12	585	146	0	17000
AMS-4	7	16	127	53	26	0	109	29	0	2300
AMS-5	7	15	54	34	26	0	72	25	0	4400
AMS-6	7	23	67	48	26	3.2	453	55	0	3200
AMS-7	7	7.9	62	30	26	0	83	24	0	7800
AMS-8A	7	25	290	118	26	0	1135	130	7.9	900
AMS-9C[b]	7	29	234	123	26	9.2	409	102	0	562
AMS-22	7	0.5	173	59	26	0	89	35	0	101
AMS-23	7	15	115	63	26	0	202	49	9.0	194
AMS-24	7	12	112	40	26	0	112	24	0	65
AMS-25	7	0.5	125	34	26	0	402	33	0	79
AMS-26	7	9.4	40	27	26	0	171	31	0	98
AMS-27	7	22	68	38	26	0	101	30	0	64
AMS-28	7	8.0	142	49	26	0	445	40	0	216
AMS-29	7	18	124	62	26	0	199	41	0	121
Background										
AMS-12	7	5.1	23	12	26	0	45	8.1	0	480
AMS-16	7	4.0	36	16	26	0	37	16	0	350

[a]For blank corrected concentrations less than or equal to 0.0 pCi/m^3, the concentration is set as 0.0 pCi/m^3.
[b]Summary results for 1990 through 1998 include AMS-9B/C data.

TABLE 4-2

TOTAL PARTICULATE CONCENTRATIONS IN AIR

Location	First Quarter 2000 Results (µg/m³)				1999 Summary Results (µg/m³)				1990 through 1998 Summary Results (µg/m³)	
	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
Fenceline										
AMS-2	7	17	25	22	26	11	69	34	7.0	77
AMS-3	7	17	27	23	26	19	83	37	8.0	159
AMS-4	7	19	29	24	26	18	74	38	13	79
AMS-5	7	20	30	23	26	18	45	29	9.6	62
AMS-6	7	20	27	24	26	19	48	32	8.0	69
AMS-7	7	20	31	26	26	20	84	34	6.8	76
AMS-8A	7	20	67	31	26	20	63	37	13	89
AMS-9C[a]	7	19	29	24	26	19	66	38	7.1	136
AMS-22	7	21	36	29	26	16	53	37	13	57
AMS-23	7	17	25	22	26	18	57	30	15	51
AMS-24	7	17	33	25	26	13	57	38	18	79
AMS-25	7	23	30	27	26	17	45	31	21	69
AMS-26	7	20	31	23	26	19	52	31	15	51
AMS-27	7	30	59	41	26	16	92	50	24	86
AMS-28	7	16	31	21	26	15	51	28	12	49
AMS-29	7	18	29	23	26	18	52	33	11	62
Background										
AMS-12[b]	7	17	29	22	26	16	48	29	6.0	416
AMS-16[b]	7	27	52	36	26	26	61	44	18	84

[a]Summary results for 1990 through 1998 include AMS-9B/C data.
[b]Total particulate analysis was discontinued during 1994 and was reinstated for AMS-12 and AMS-16 in 1997.

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TABLE 4-3

FIRST QUARTER NESHAP COMPLIANCE TRACKING

	40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios[a]													
Location	Ac-228[b]	Ra-224[b]	Ra-226	Ra-228[b]	Th-228	Th-230	Th-231[b]	Th-232	Th-234[b]	U-234	U-235/ U-236	U-238	Ratio Totals	Dose[c] (mrem)
Fenceline														
AMS-2	-	-	-[d]	-	-	2.8E-03	1.3E-09	-	3.3E-06	5.6E-04	5.1E-05	8.6E-04	4.3E-03	0.043
AMS-3	5.7E-07	1.4E-05	4.6E-03	3.6E-04	4.2E-04	2.3E-02	3.6E-09	3.4E-03	1.0E-05	1.9E-03	1.4E-04	2.7E-03	3.7E-02	0.370
AMS-4	5.4E-08	1.3E-06	-	3.4E-05	-	4.7E-03	1.6E-09	3.2E-04	2.8E-06	5.4E-04	6.2E-05	7.5E-04	6.4E-03	0.064
AMS-5	4.2E-08	1.0E-06	5.8E-04	2.6E-05	-	3.5E-03	3.0E-10	2.5E-04	1.6E-06	2.7E-04	1.2E-05	4.4E-04	5.1E-03	0.051
AMS-6	1.1E-07	2.7E-06	-	6.9E-05	-	3.6E-03	4.5E-10	6.5E-04	2.5E-06	4.8E-04	1.8E-05	6.8E-04	5.5E-03	0.055
AMS-7	-	-	6.1E-04	-	-	7.3E-04	5.1E-10	-	9.5E-07	1.5E-04	2.0E-05	2.5E-04	1.8E-03	0.018
AMS-8A	1.2E-07	2.9E-06	-	7.4E-05	-	7.8E-03	1.3E-09	7.1E-04	5.6E-06	9.9E-04	5.2E-05	1.5E-03	1.1E-02	0.111
AMS-9C	4.3E-07	1.1E-05	3.5E-03	2.7E-04	-	1.2E-02	2.4E-09	2.6E-03	7.3E-06	1.5E-03	9.4E-05	1.9E-03	2.2E-02	0.220
AMS-22	-	-	-	-	-	3.2E-03	-	-	3.4E-06	4.4E-04	-	9.1E-04	4.6E-03	0.046
AMS-23	4.2E-08	1.0E-06	3.6E-03	2.6E-05	-	4.6E-03	1.4E-09	2.5E-04	3.2E-06	5.7E-04	5.5E-05	8.5E-04	1.0E-02	0.100
AMS-24	-	-	3.1E-04	-	-	4.1E-03	3.4E-10	-	1.9E-06	3.1E-04	1.3E-05	5.0E-04	5.2E-03	0.052
AMS-25	1.3E-07	3.2E-06	5.7E-03	8.1E-05	2.1E-06	4.1E-03	-	7.7E-04	1.6E-06	3.3E-04	-	4.3E-04	1.1E-02	0.114
AMS-26	-	-	-	-	-	2.3E-03	3.1E-10	-	1.1E-06	2.3E-04	1.2E-05	3.0E-04	2.8E-03	0.028
AMS-27	2.0E-09	4.9E-08	3.6E-03	1.3E-06	-	2.1E-03	-	1.2E-05	1.3E-06	1.9E-04	-	3.3E-04	6.2E-03	0.062
AMS-28	-	-	-	-	-	2.7E-03	-	-	2.4E-06	2.6E-04	-	6.3E-04	3.6E-03	0.036
AMS-29	1.8E-07	4.6E-06	4.0E-03	1.2E-04	1.2E-04	6.4E-03	1.8E-09	1.1E-03	4.6E-06	9.6E-04	7.2E-05	1.2E-03	1.4E-02	0.140
Background														
AMS-12	1.8E-07	4.4E-06	8.6E-03	1.1E-04	5.1E-04	3.3E-04	6.2E-10	1.1E-03	7.0E-07	2.1E-04	2.4E-05	1.9E-04	NA[e]	
AMS-16	5.0E-07	1.2E-05	8.1E-03	3.1E-04	9.6E-04	8.0E-04	-	3.0E-03	1.0E-06	2.8E-04	-	2.6E-04	NA[e]	
QA/QC														
Column Check[f]	0.000	0.000	0.264	0.011	0.005	0.883	0.000	0.101	0.001	0.097	0.006	0.143	NA[e]	1.51

Maximum Quarterly Ratio: 0.0370
Maximum Quarterly Dose (mrem): 0.370

[a]A "-" indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the average net background concentrations.
[b]Isotopes assumed to be in equilibrium with their parents.
[c]Dose conversions are based on the NESHAP standard of 10 mrem per year.
[d]Denotes AMS-2 radium-226 analysis rejected due to inadequate detection level
[e]NA = not applicable
[f]Column check is the sum of doses from each radionuclide, followed by the sum of doses (1.51) at all fenceline monitors.

TABLE 4-4

NESHAP STACK EMISSION MONITORING RESULTS

Analysis Performed	First Quarter 2000 Results: No. of Samples[a,b]	First Quarter 2000 Results: Total Pounds[a,c]	1999 Summary Results: No. of Samples[a]	1999 Summary Results: Total Pounds[a,c]
Building 71 Stack				
Uranium, Total	1	ND	5	2.6E-05
Thorium-232	1	8.9E-06	5	5.2E-05
Thorium-230	1	1.5E-10	5	1.0E-09
Total Particulate	1	0.0E+00	3[d]	5.8E-01
Laundry Stack				
Uranium, Total	1	ND	9[e]	2.6E-05
Thorium-232	1	4.3E-05	9[e]	5.8E-04
Thorium-230	1	9.0E-10	9[e]	6.9E-09
Total Particulate	1	5.3E-02	7[d,e]	6.0E-01
WPRAP Dryer Stack				
Uranium-238	3	2.2E-06	1	ND
Uranium-235/236	3	0.0E+00	1	ND
Uranium-234	3	1.9E-10	1	ND
Thorium-232	3	0.0E+00	1	ND
Thorium-230	3	2.8E-10	1	ND
Thorium-228	3	3.7E-16	1	ND
Radium-226[f]	3	3.1E-11	1	ND
Total Particulate	NS	NS	NS	NS

Analysis Performed	First Quarter 2000 Results: Average Daily Release Rate (µCi)[g]	First Quarter 2000 Results: Maximum Daily Release Rate (µCi)[g]	First Quarter 2000 Results: Estimated Maximum Hourly Release Rate for Radon-222 (µCi/hr)
WPRAP Dryer Stack			
Radon-220/222	417	6,912	13,000

[a]ND = non-detectable
NS = not sampled
[b]WPRAP dryer stack sample consisted of seven composited filters over three sampling periods.
[c]Total pounds are only determined from detected results.
[d]Some particulate result(s) could not be determined due to a damaged filter(s).
[e]Includes previously unreported results from a second quarter 1999 sample
[f]Radium-226 is not required to be analyzed in WPRAP dryer stack samples, but is provided for informational purposes.
[g]Reflects daily release rate information during period of operation from January through March

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TABLE 4-5

CONTINUOUS ENVIRONMENTAL RADON MONITORING
MONTHLY AVERAGE CONCENTRATIONS[a]

	First Quarter 2000 Monthly Results[b] (Instrument Background Corrected) (pCi/L)			First Quarter 1999 Monthly Results[b] (Instrument Background Corrected) (pCi/L)			1999 Summary Results[b] (Instrument Background Corrected) (pCi/L)		
Location	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
Fenceline									
AMS-02	0.2	0.4	0.3	0.3	0.4	0.4	0.2	1.0	0.5
AMS-03	0.3	0.4	0.4	0.1	0.2	0.2	0.1	1.0	0.5
AMS-04	0.2	0.4	0.3	0.1	0.2	0.1	0.1	0.8	0.4
AMS-05	0.2	0.5	0.3	0.2	0.3	0.3	0.2	1.4	0.7
AMS-06	0.2	0.4	0.3	0.2	0.3	0.3	0.2	0.8	0.5
AMS-07	0.3	0.5	0.4	0.3	0.5	0.4	0.3	1.5	0.8
AMS-08A[c]	0.3	0.4	0.3	0.3	0.8	0.6	0.1	0.8	0.4
AMS-09C	0.1	0.2	0.1	0.4	0.7	0.5	0.2	0.8	0.5
AMS-22	0.1	0.5	0.3	0.1	0.2	0.2	0.1	0.5	0.3
AMS-23	0.1	0.3	0.2	0.2	0.3	0.2	0.1	0.6	0.3
AMS-24[c]	0.2	0.4	0.3	0.2	0.3	0.3	0.2	1.1	0.6
AMS-25[c]	0.2	0.3	0.2	0.2	0.3	0.3	0.2	0.8	0.5
AMS-26	0.2	0.3	0.2	0.2	0.5	0.3	0.2	0.8	0.5
AMS-27	0.2	0.3	0.3	0.2	0.3	0.2	0.2	1.1	0.6
AMS-28[c]	0.2	0.7	0.4	0.1	0.1	0.1	0.1	0.8	0.4
AMS-29[c]	0.3	0.7	0.4	0.1	0.3	0.2	0.1	0.8	0.4
Background									
AMS-12	0.1	0.1	0.1	0.1	0.3	0.2	0.1	0.5	0.2
AMS-16	0.1	0.2	0.2	0.1	0.2	0.1	0.1	0.5	0.3
On Site									
KNE	1.9	2.5	2.1	7.8	18.3	12.8	1.7	18.3	9.6
KNW	1.8	3.1	2.5	2.7	4.0	3.4	2.1	8.2	3.8
KSE	1.3	2.2	1.7	4.7	9.9	6.8	1.2	9.9	4.9
KSW	1.2	1.8	1.4	3.3	4.1	3.6	1.7	4.8	3.1
KTOP	3.8	4.0	3.9	11.0	15.8	13.2	3.4	15.8	8.4
Pilot Plant Warehouse	0.2	0.3	0.2	0.3	0.4	0.3	0.3	0.8	0.4
Rally Point 4	0.3	0.4	0.3	0.6	1.3	0.9	0.5	1.3	0.8
Surge Lagoon	0.2	0.3	0.3	0.4	0.5	0.4	0.4	1.0	0.7
T28	0.8	1.2	1.0	1.5	1.6	1.5	1.1	3.8	2.2
TS4[d]	0.1	0.2	0.2	0.2	0.5	0.3	0.2	0.9	0.5
WP-17A	0.2	0.4	0.3	0.1	0.2	0.2	0.1	1.1	0.6

[a]Monthly average radon concentrations are calculated from daily average concentrations. Daily average concentrations are calculated by summing all hourly count data, treating the sum as a single daily measurement, and then converting the sum to a (daily average) concentration.
[b]Instrument background changes as monitors are replaced
[c]Unit was placed in service in December 1998.
[d]Unit was placed in service in January 1999.

TABLE 4-6

2000 FIRST QUARTER RADON CONCENTRATIONS
100 pCi/L EXCEEDANCES AT THE K-65 SILOS 1 AND 2 EXCLUSION FENCE

Exceedance Event Start Date	Duration of Exceedance (hours)	Maximum Recorded Hourly Radon Concentration (pCi/L)	Monitoring Location(s)
3/27	1	131	KNW

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TABLE 4-7

RADON HEADSPACE CONCENTRATIONS

	Radon Headspace Concentrations[a,b,c] (pCi/L)											
	Silo 1 2000			Silo 1 1999			Silo 2 2000			Silo 2 1999		
Month	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
January	1.71E+07	2.09E+07	1.81E+07	1.24E+07	1.44E+07	1.34E+07	1.44E+07	1.98E+07	1.66E+07	8.78E+06	1.11E+07	9.95E+06
February	1.58E+07	1.76E+07	1.69E+07	1.27E+07	1.35E+07	1.32E+07	1.50E+07	1.96E+07	1.75E+07	8.70E+06	9.68E+06	9.20E+06
March	1.56E+07	1.73E+07	1.64E+07	1.25E+07	1.33E+07	1.29E+07	1.45E+07	1.66E+07	1.56E+07	8.66E+06	9.89E+06	9.30E+06

[a]Minimum equals minimum recorded daily average radon concentration.
[b]Maximum equal maximum recorded daily average radon concentration.
[c]Average equals monthly average of recorded daily radon concentrations.

TABLE 4-8

DIRECT RADIATION (TLD) MEASUREMENTS

Location	Direct Radiation (mrem)		
	First Quarter 2000 Results	1999 Summary Results[b]	1998 Summary Results[a]
Fenceline			
2	18	75	74
3	17	72	67
4	16	68	66
5	15	70	68
6	19	81	84
7	15	68	69
8A	16	74	75
9C	17	76	79
13	17	74	74
14	17	71	77
15	18	79	79
16	18	81	81
17	17	70[c]	73
34	17	75	75
35	16	71	70
36	15	64	65
37	18	76	77
38	14	63	63
39	18	79	79
40	15	68	67
41	17	72	73
Min.	**14**	**63**	**63**
Max.	**19**	**81**	**84**
On Site			
22	283	904	776
23A[d]	241	866[e]	NA
24	219	707	632[f]
25	205	881	698
26	137	547	496
32	13	55	55
Min.	**13**	**55**	**55**
Max.	**283**	**904**	**817**
Background			
18	18	77	77
19	15	63	65
20	15	62	61
27	14	62	64
33	16	67	68
Min.	**14**	**62**	**61**
Max.	**18**	**77**	**77**

[a]NA = not applicable
[b]1999 summary result value may not always agree with quarterly results due to rounding differences.
[c]Estimated second quarter direct radiation levels
[d]LD location 23 was relocated to TLD location 23A on May 26, 1999.
[e]Direct radiation levels for TLD locations 23 and 23A were extrapolated.
[f]Direct radiation value includes estimated second quarter results which were based on first quarter results.

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FIGURE 4-1

AIR SAMPLING ACTIVITIES

SAMPLING ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Radiological Particulate Monitoring:	◆	◆	◆	☒	☒	☒						
NESHAP Quarterly Composite			◆			☒						
NESHAP Stack Emissions Monitoring	◆	◆	◆	☒	☒	☒						
Radon Monitoring – Continuous Alpha Scintillation Monitors	◆	◆	◆	☒	☒	☒						
Direct Radiation (TLD) Monitoring			◆			☒						

◆ Data summarized/evaluated in this report
☒ Data summarized/evaluated in the next report

FINAL

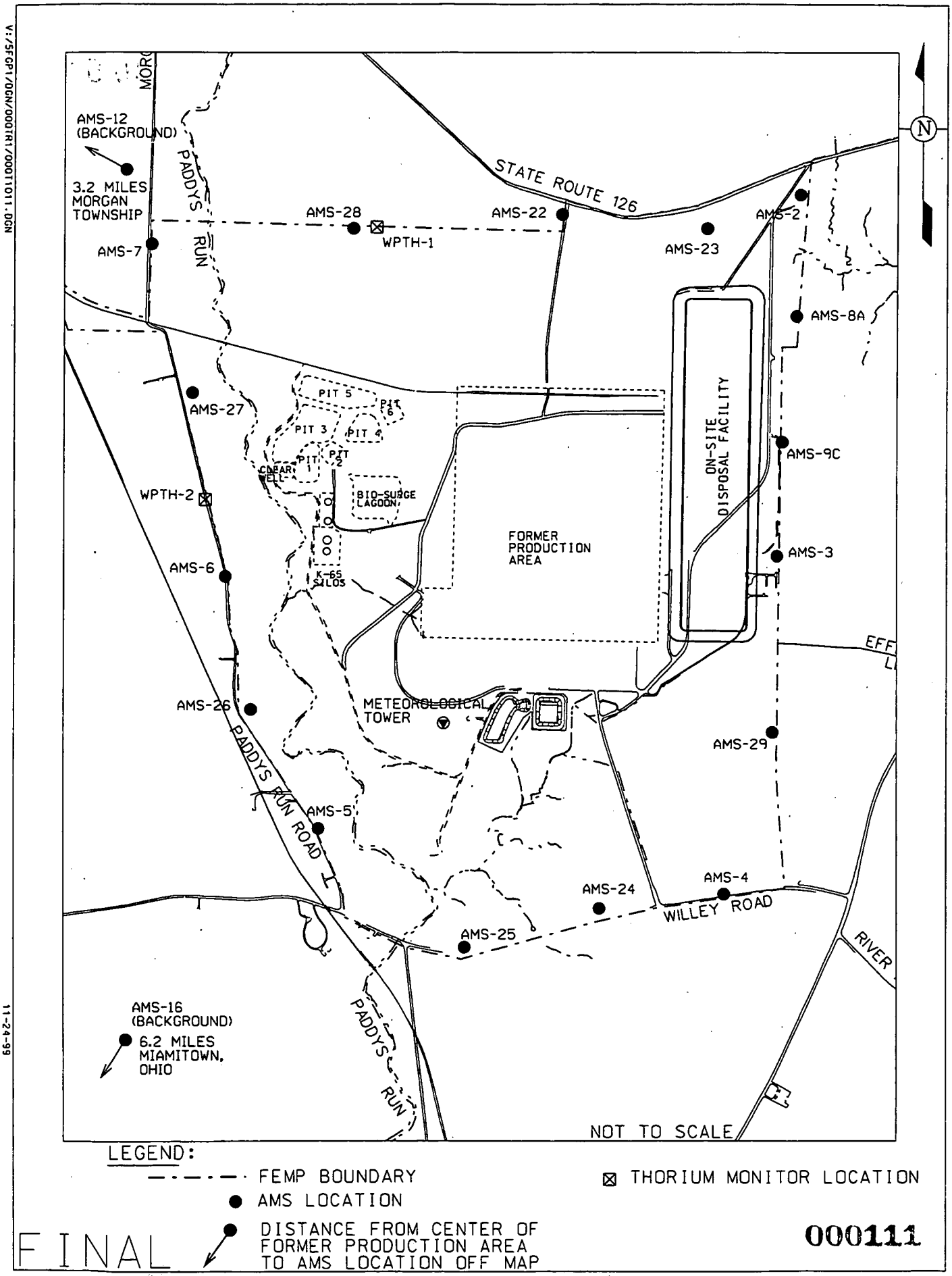

FIGURE 4-2. IEMP AIR MONITORING LOCATIONS

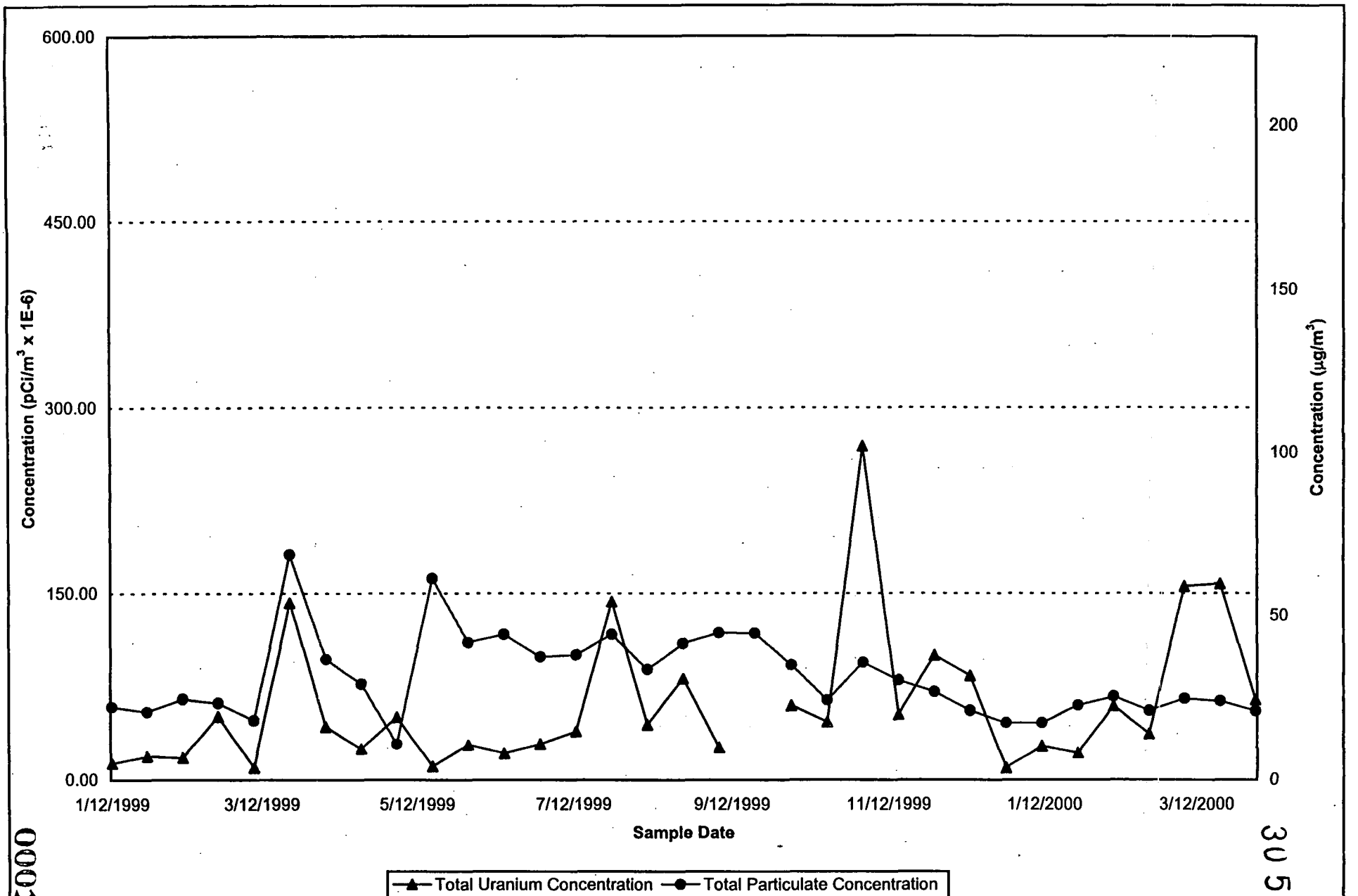

FIGURE 4-3. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-2)

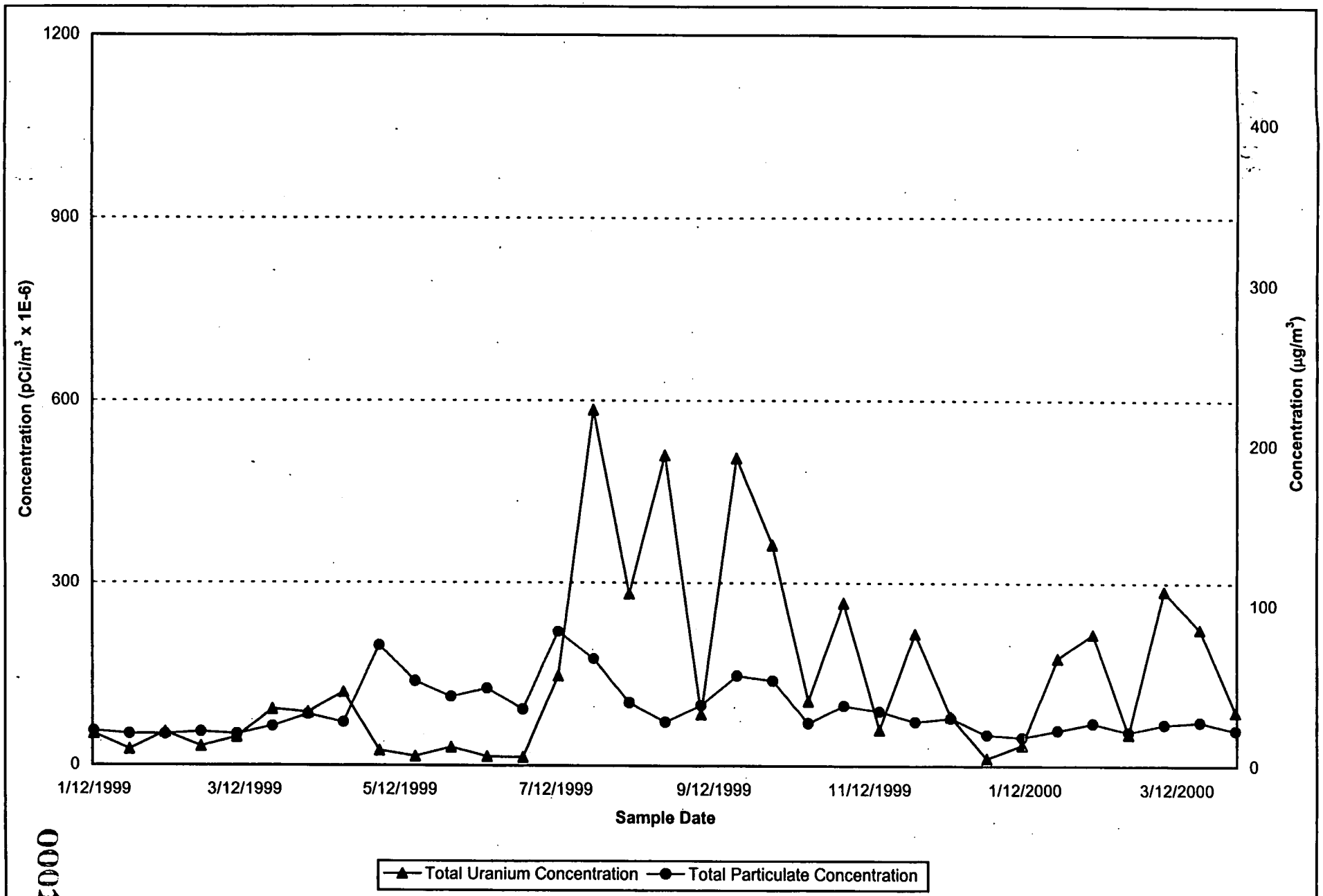

FIGURE 4-4. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-3)

FINAL

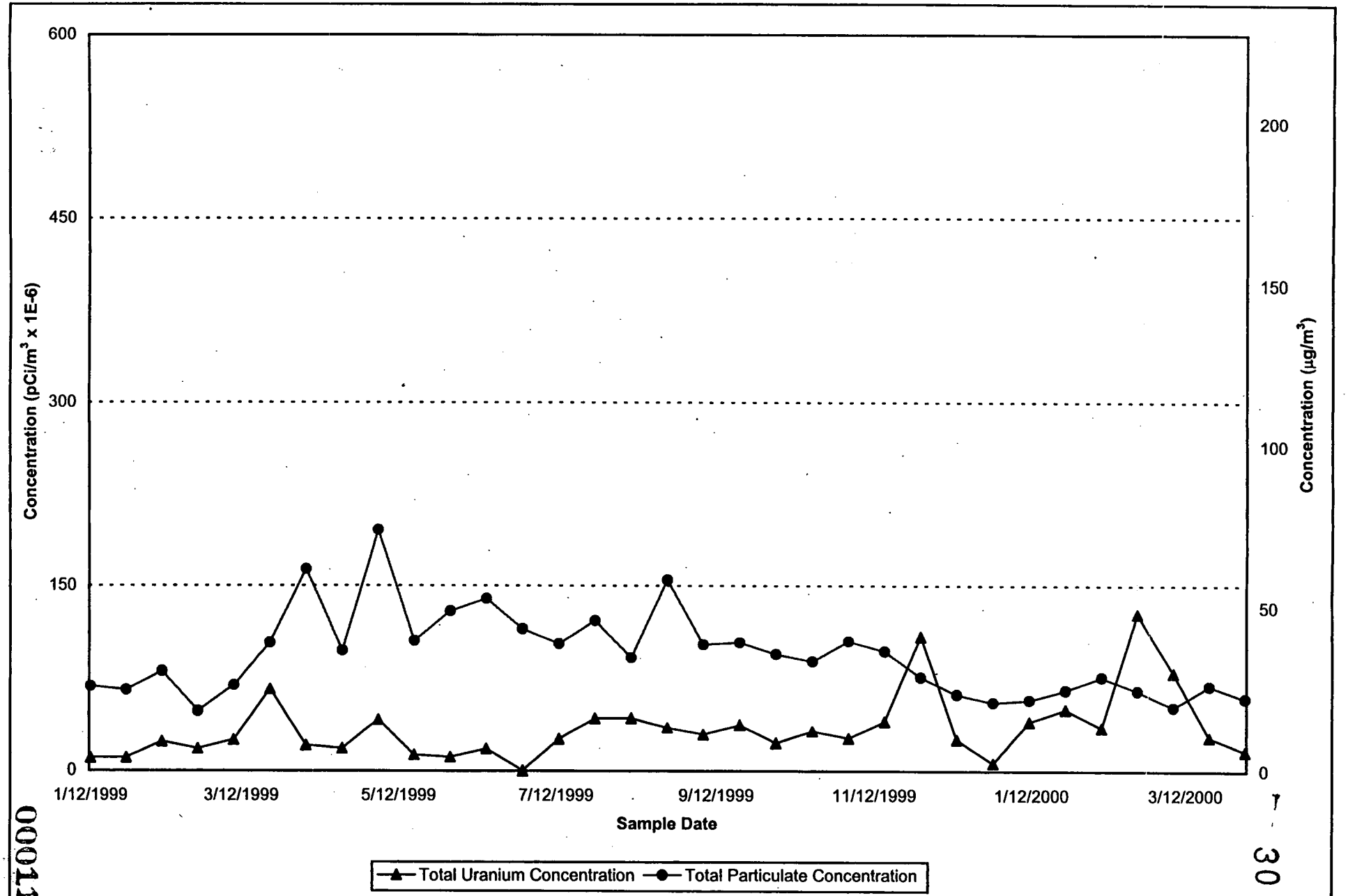

FIGURE 4-5. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-4)

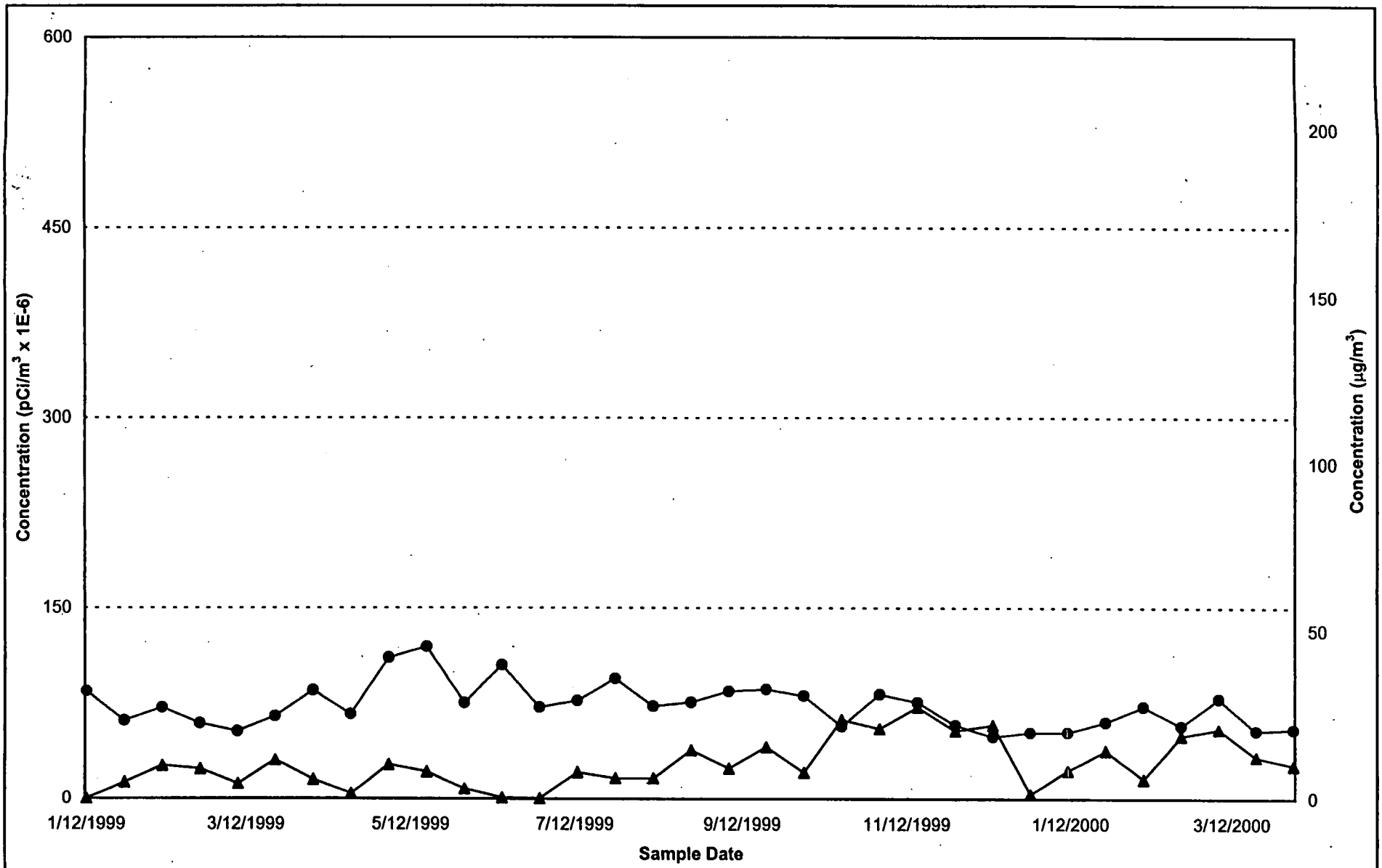

FIGURE 4-6. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-5)

FINAL

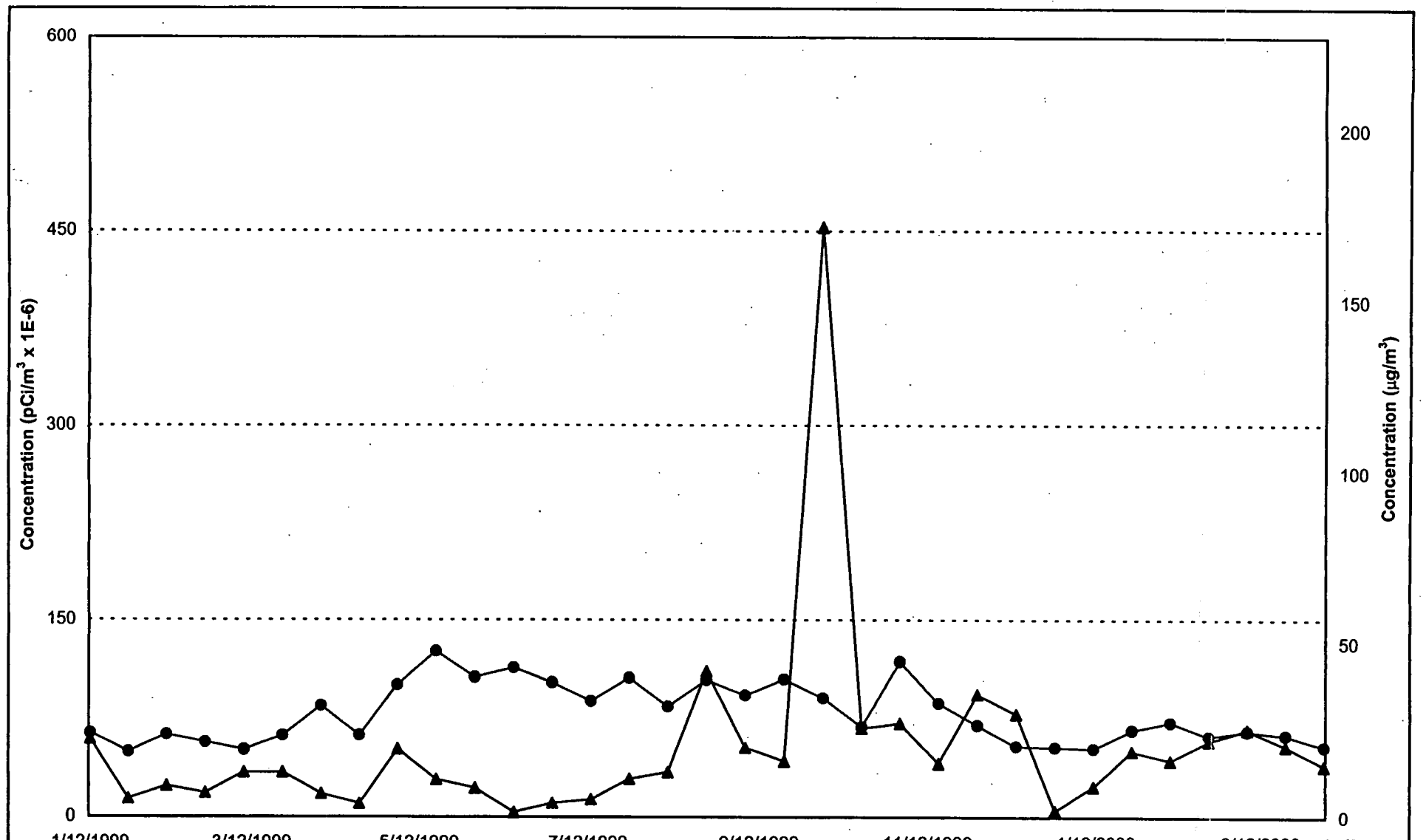

FIGURE 4-7. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-6)

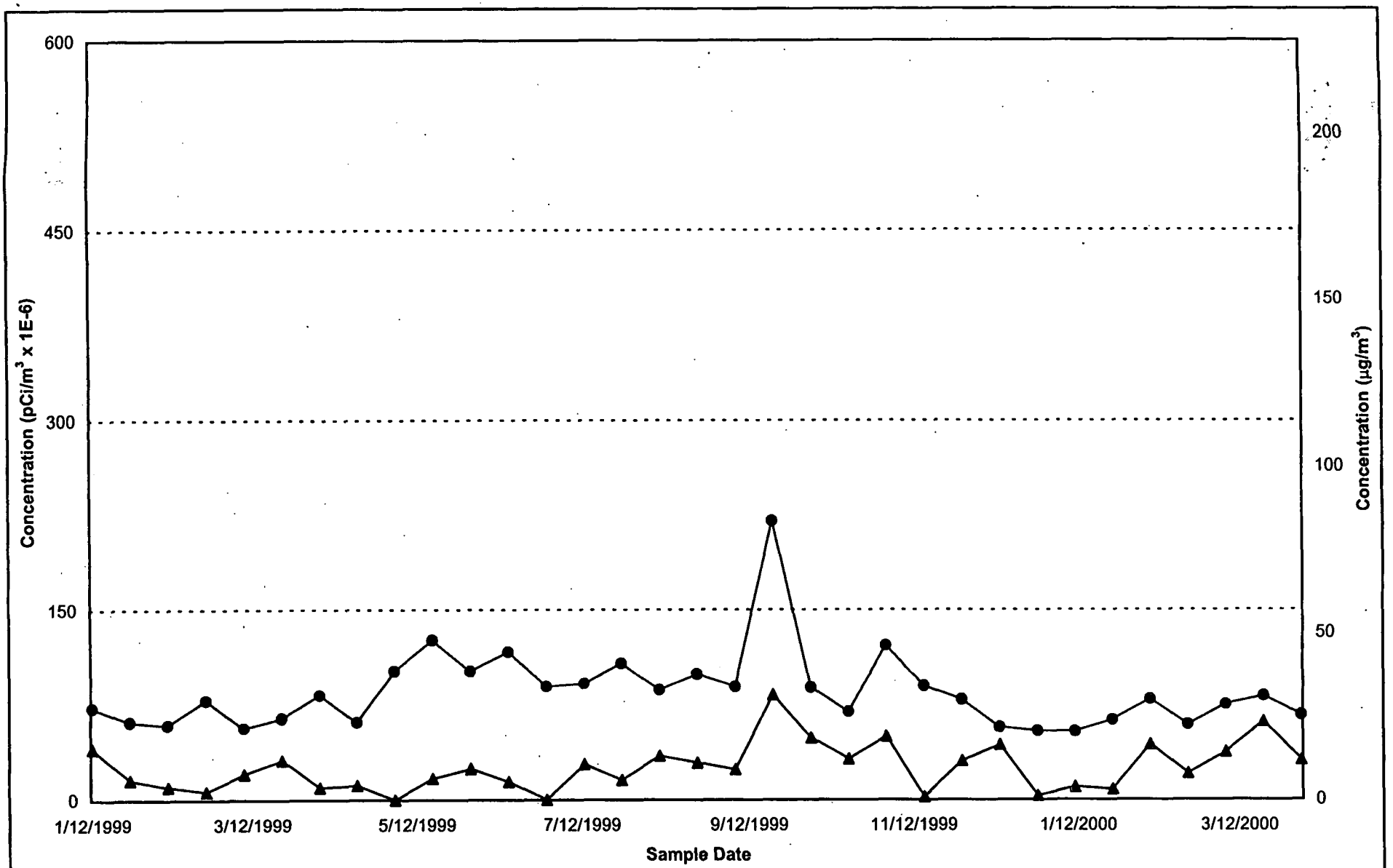

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FIGURE 4-8. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-7)

FINAL

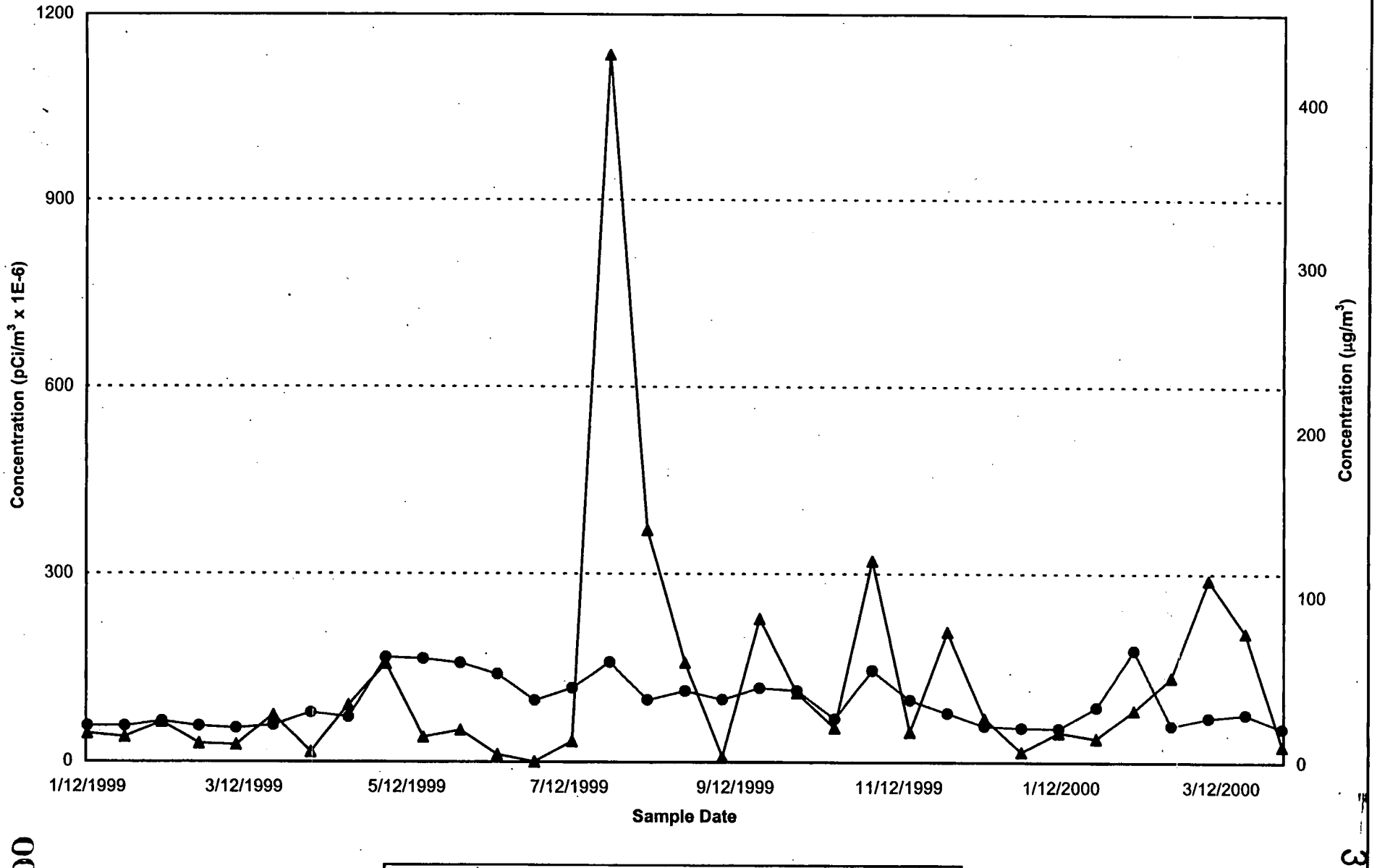

FIGURE 4-9. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-8A)

FINAL

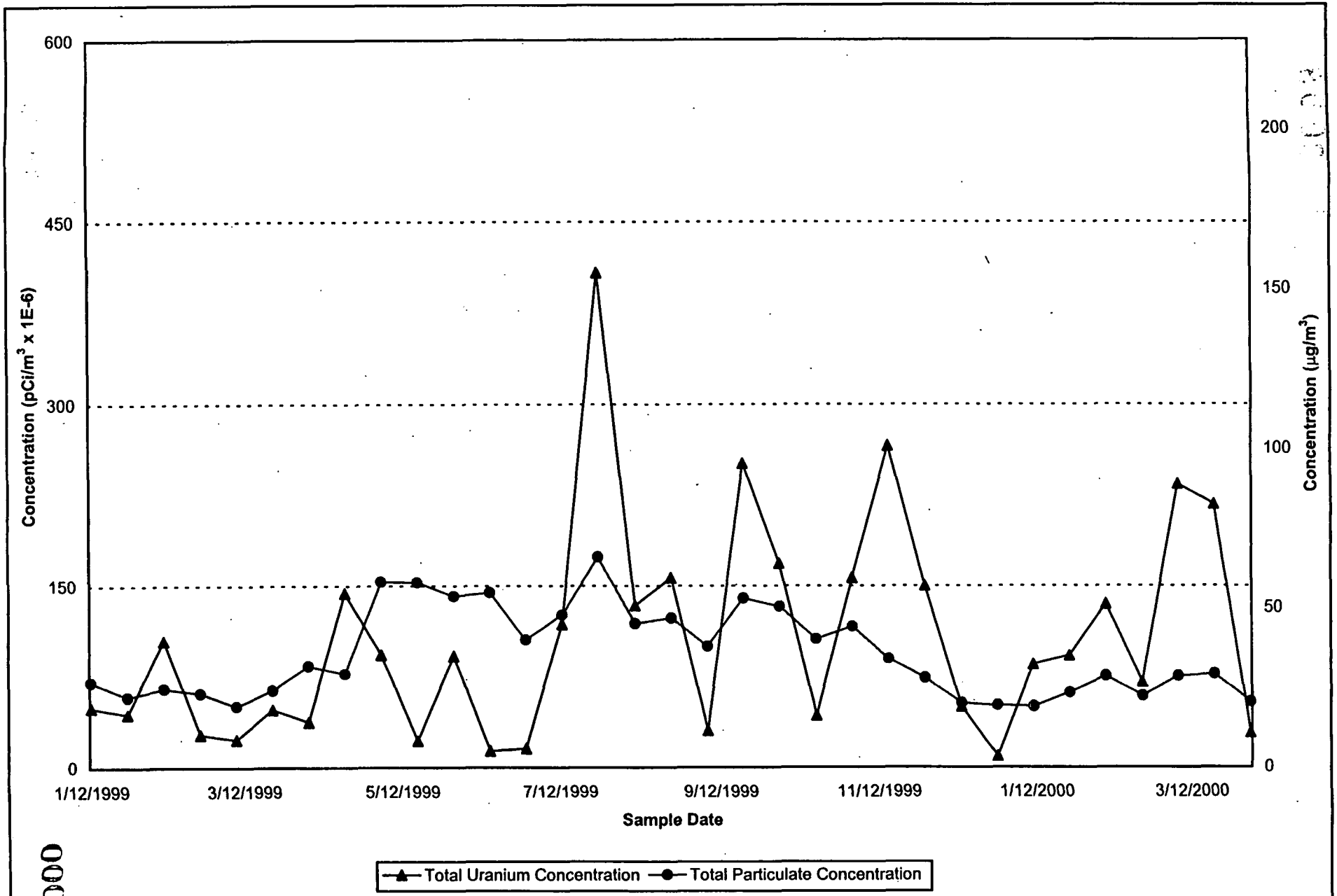

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FIGURE 4-10. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-9C)

FINAL

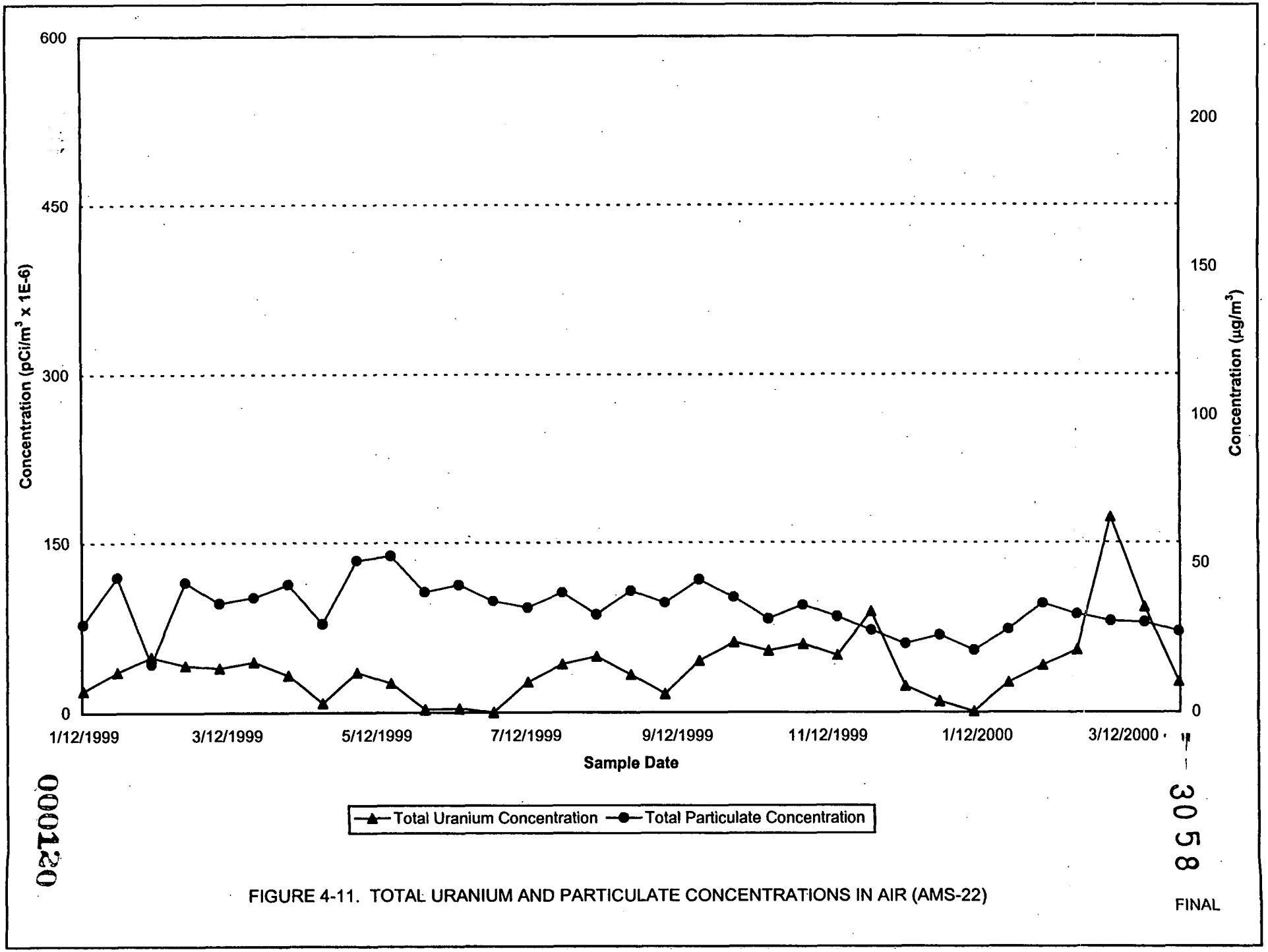

FIGURE 4-11. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-22)

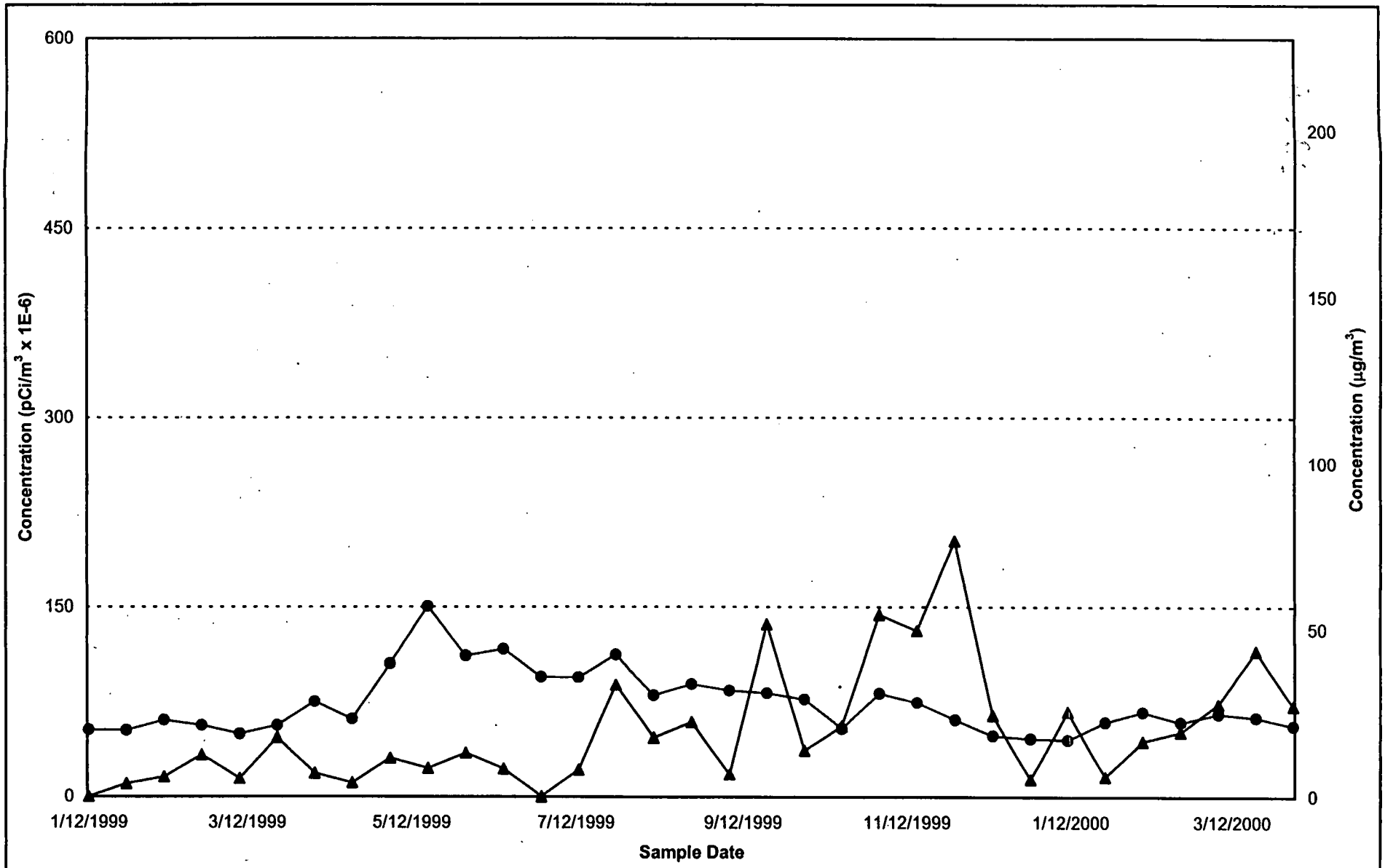

FIGURE 4-12. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-23)

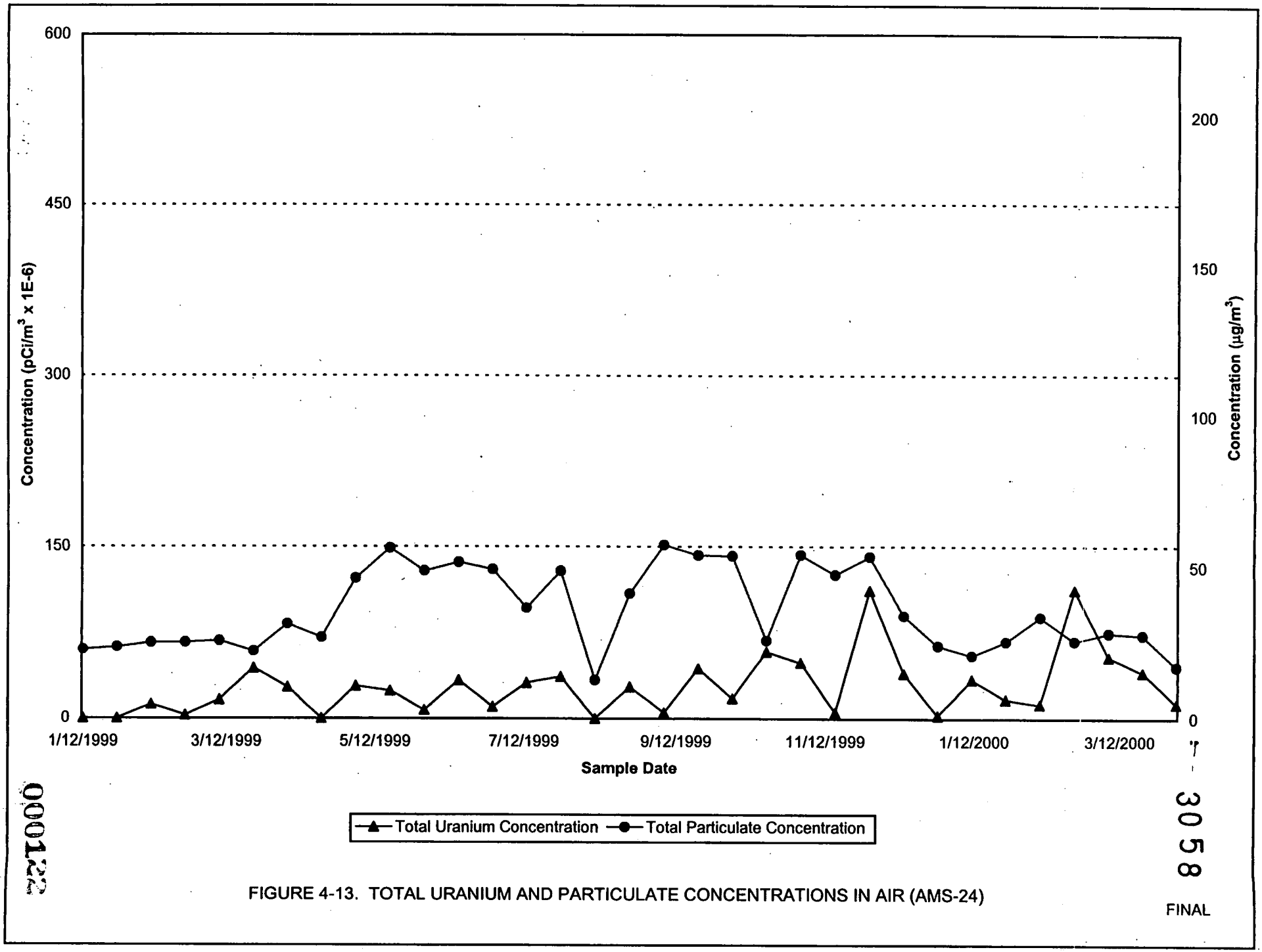

FIGURE 4-13. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-24)

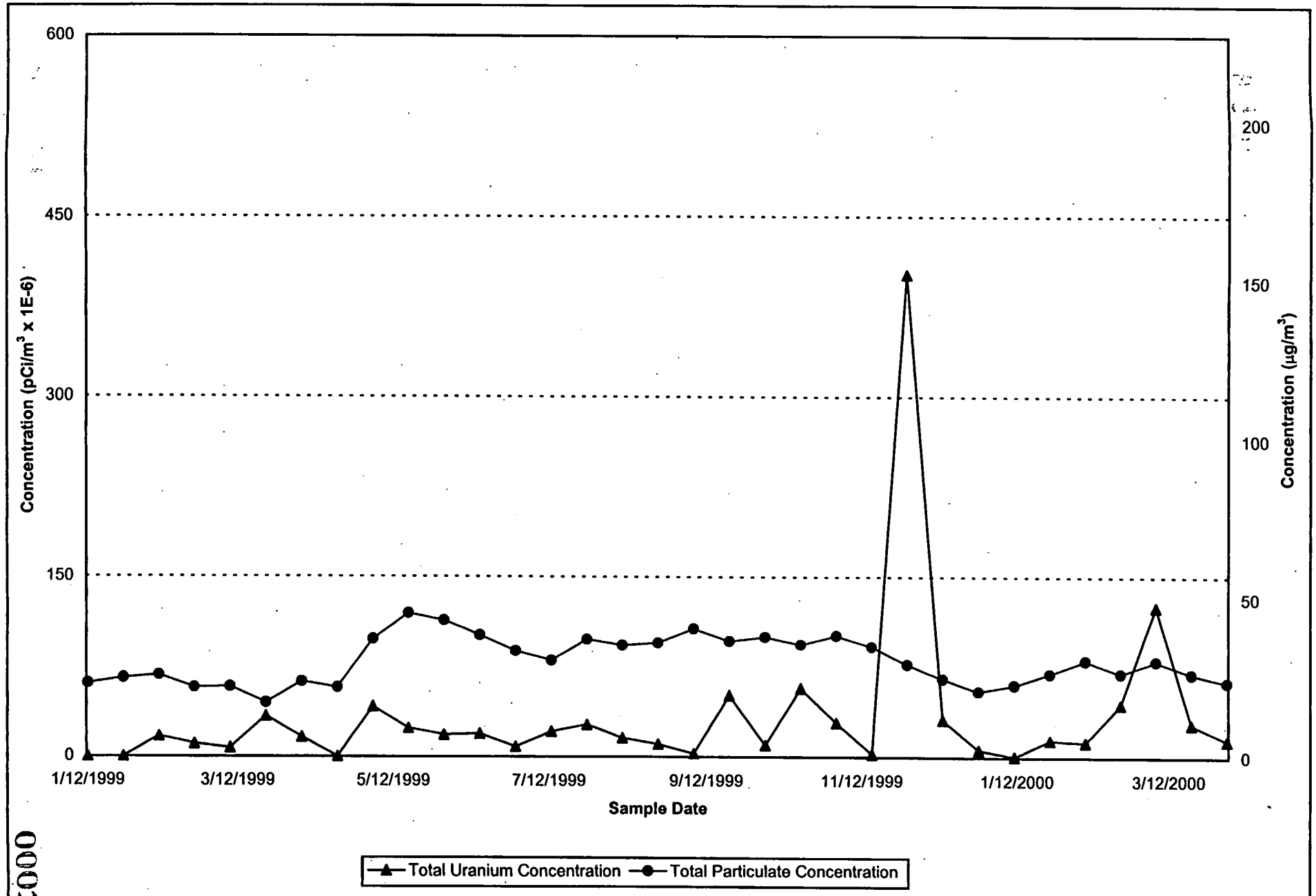

FIGURE 4-14. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-25)

FINAL

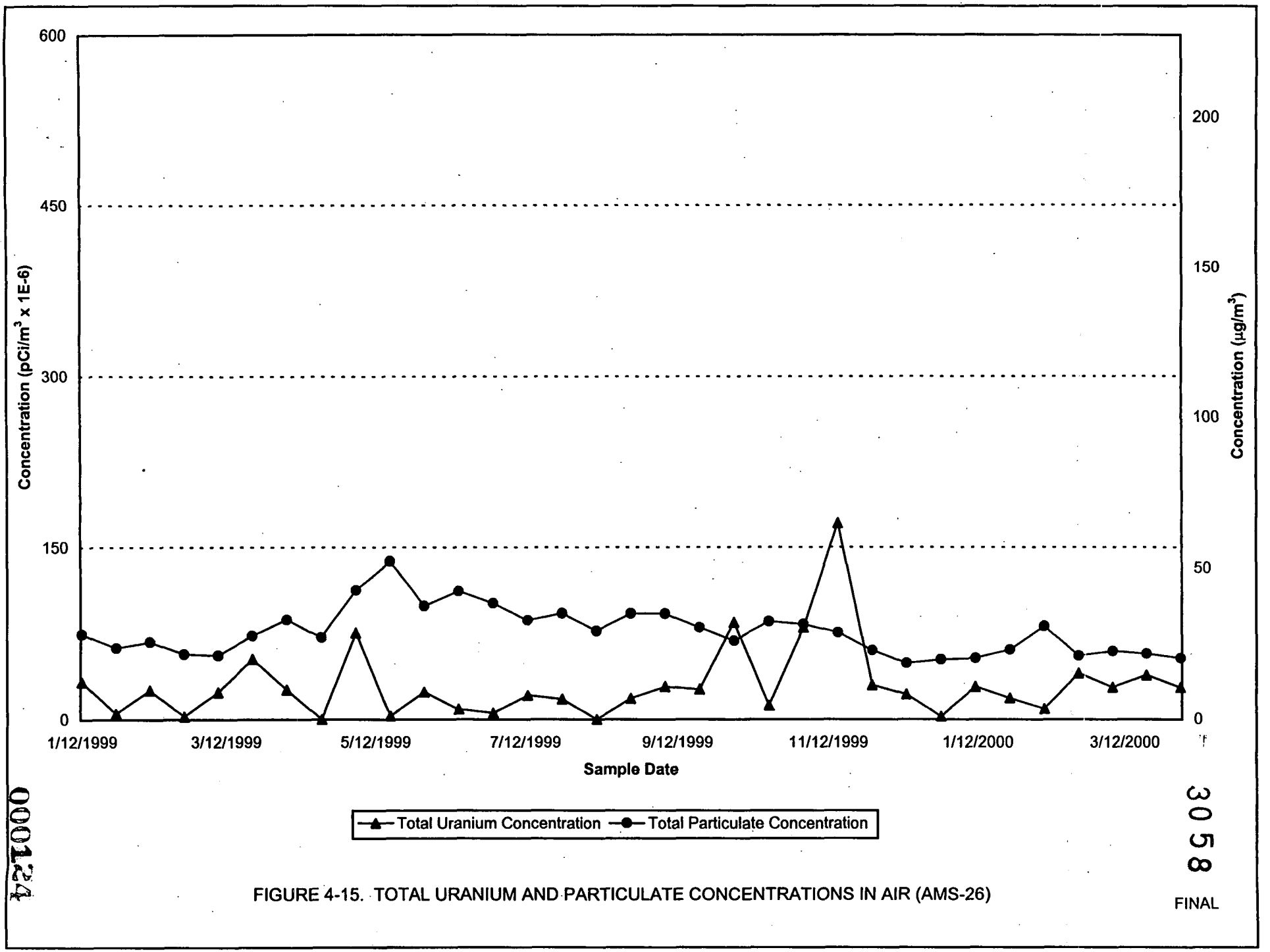

FIGURE 4-15. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-26)

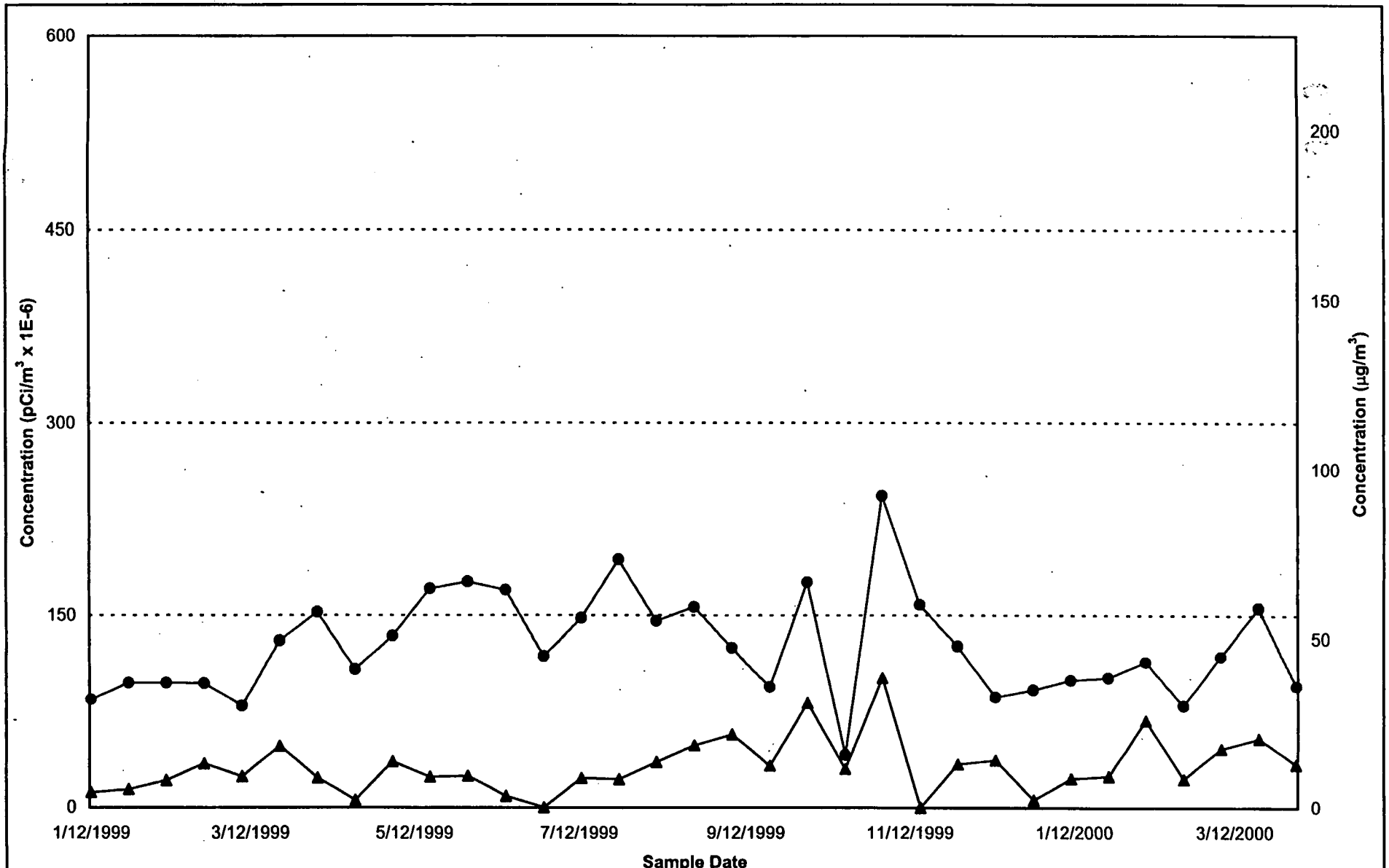

FIGURE 4-16. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-27)

FINAL

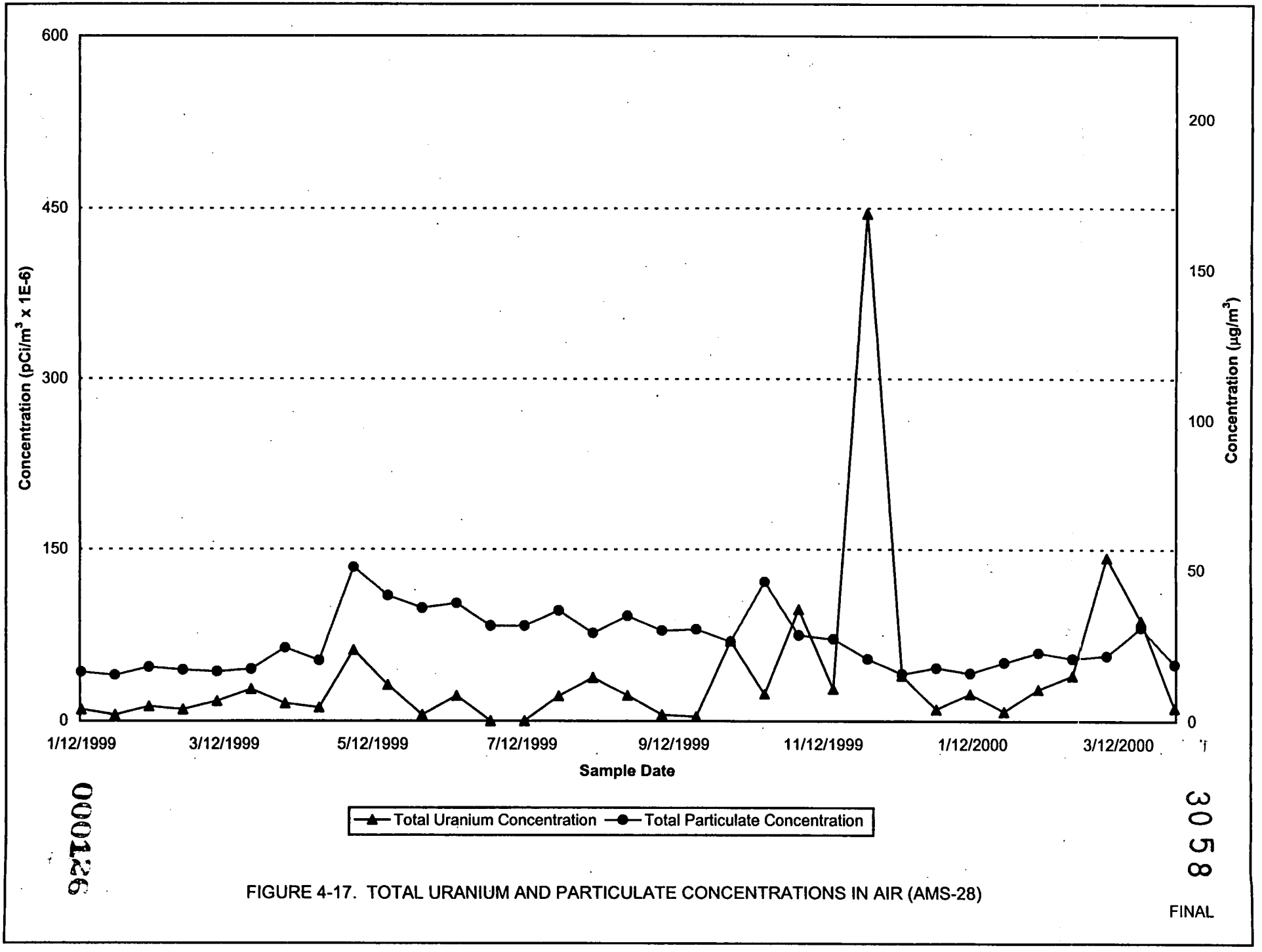

FIGURE 4-17. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-28)

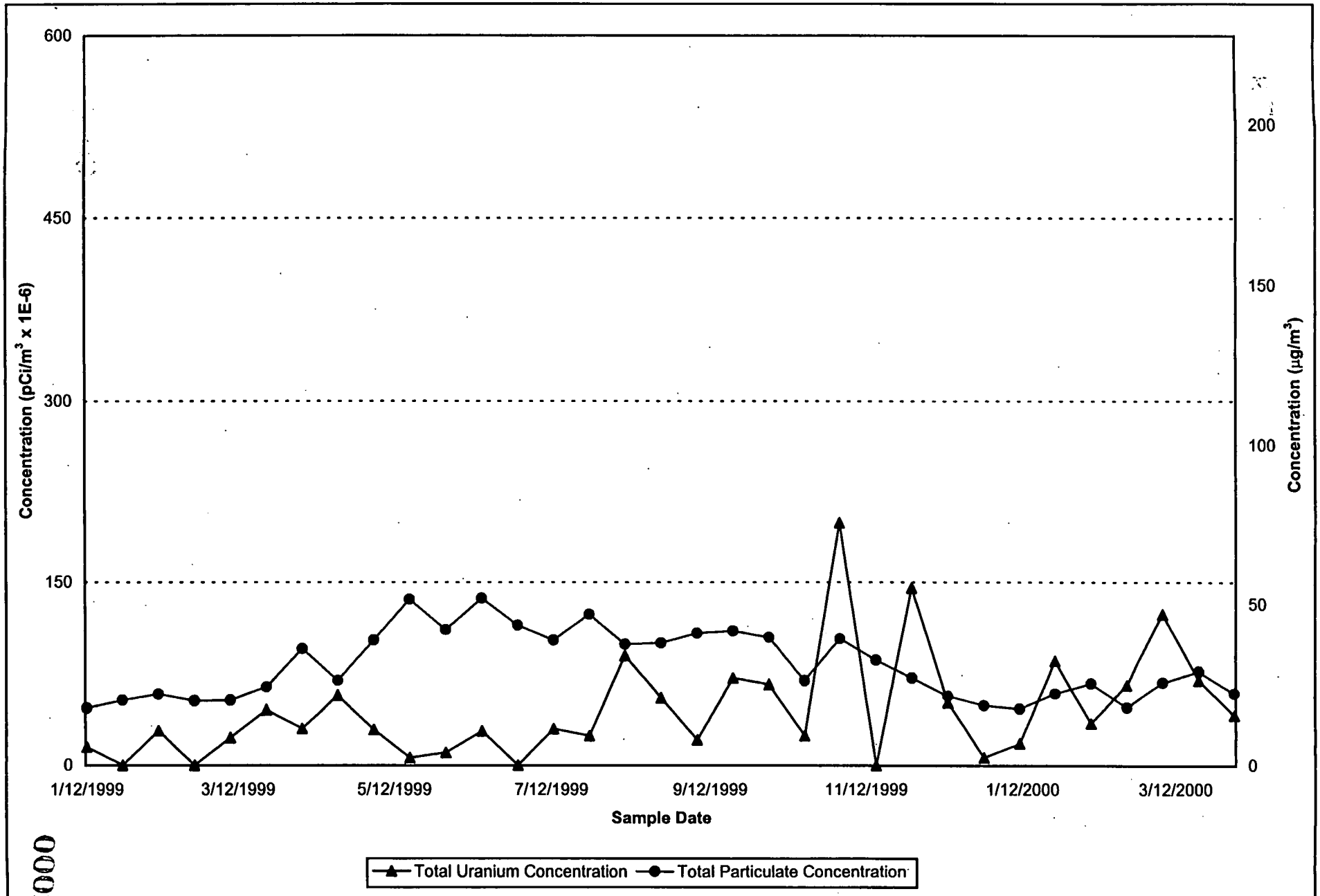

FIGURE 4-18. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-29)

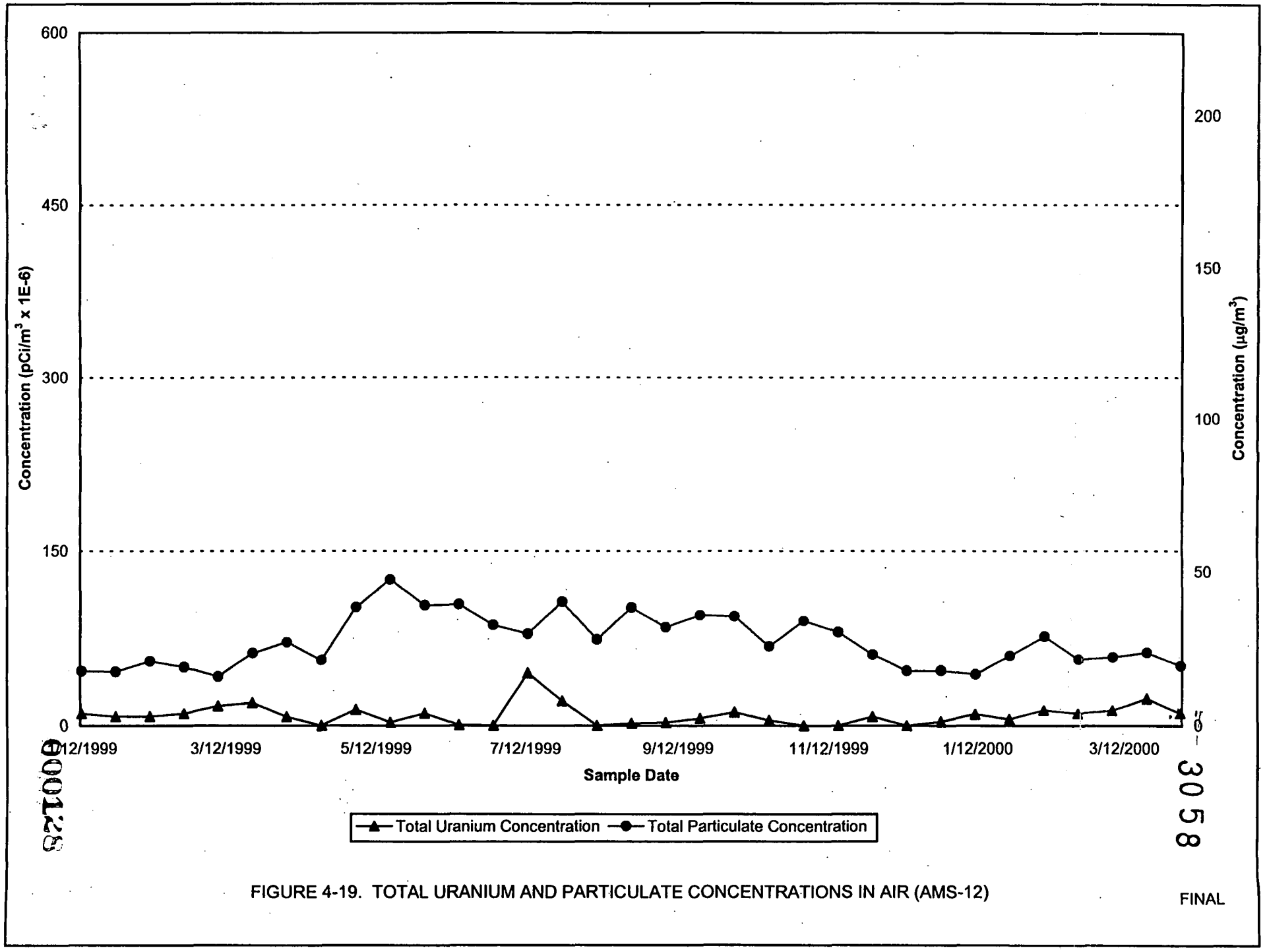

FIGURE 4-19. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-12)

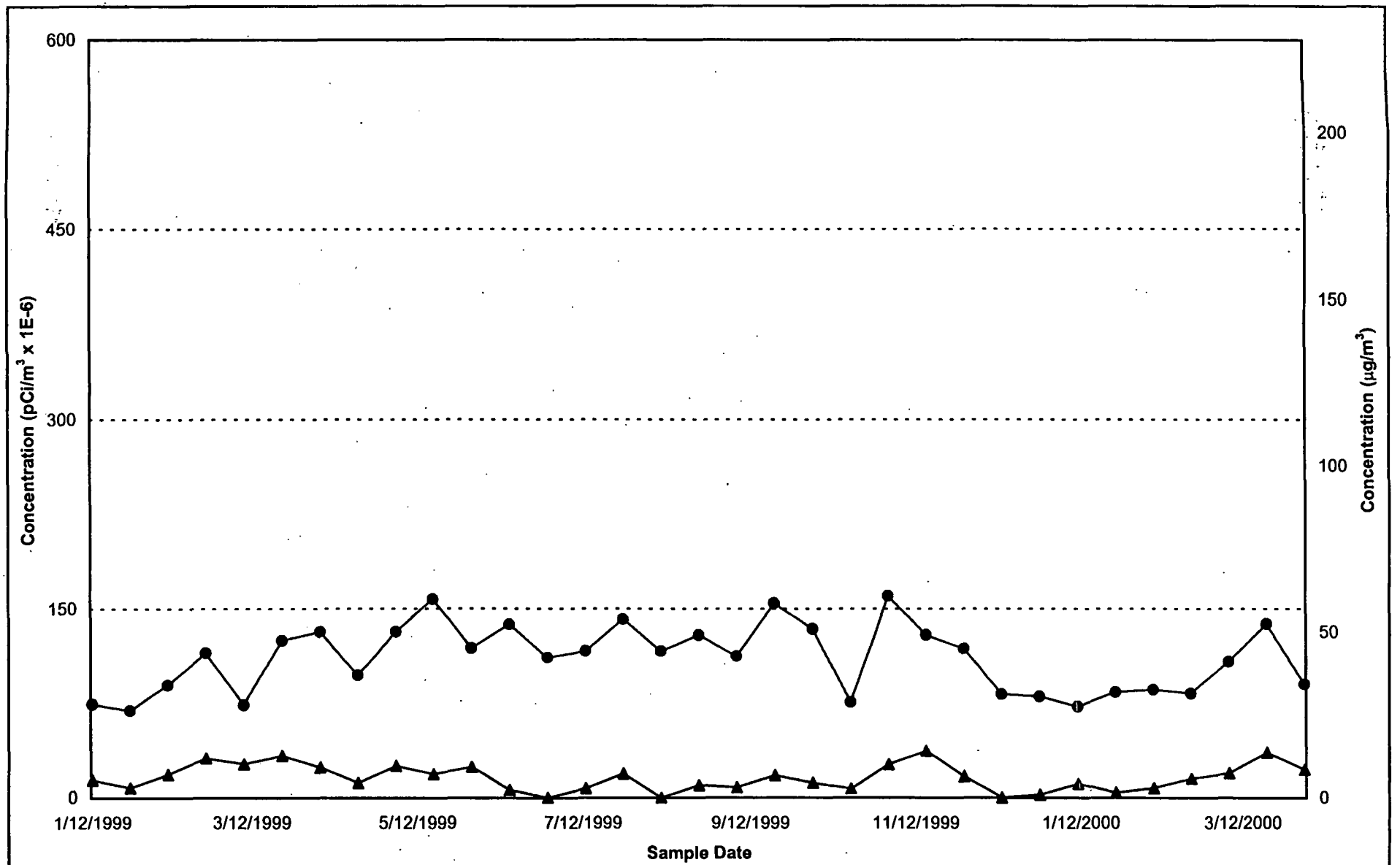

FIGURE 4-20. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-16)

FINAL

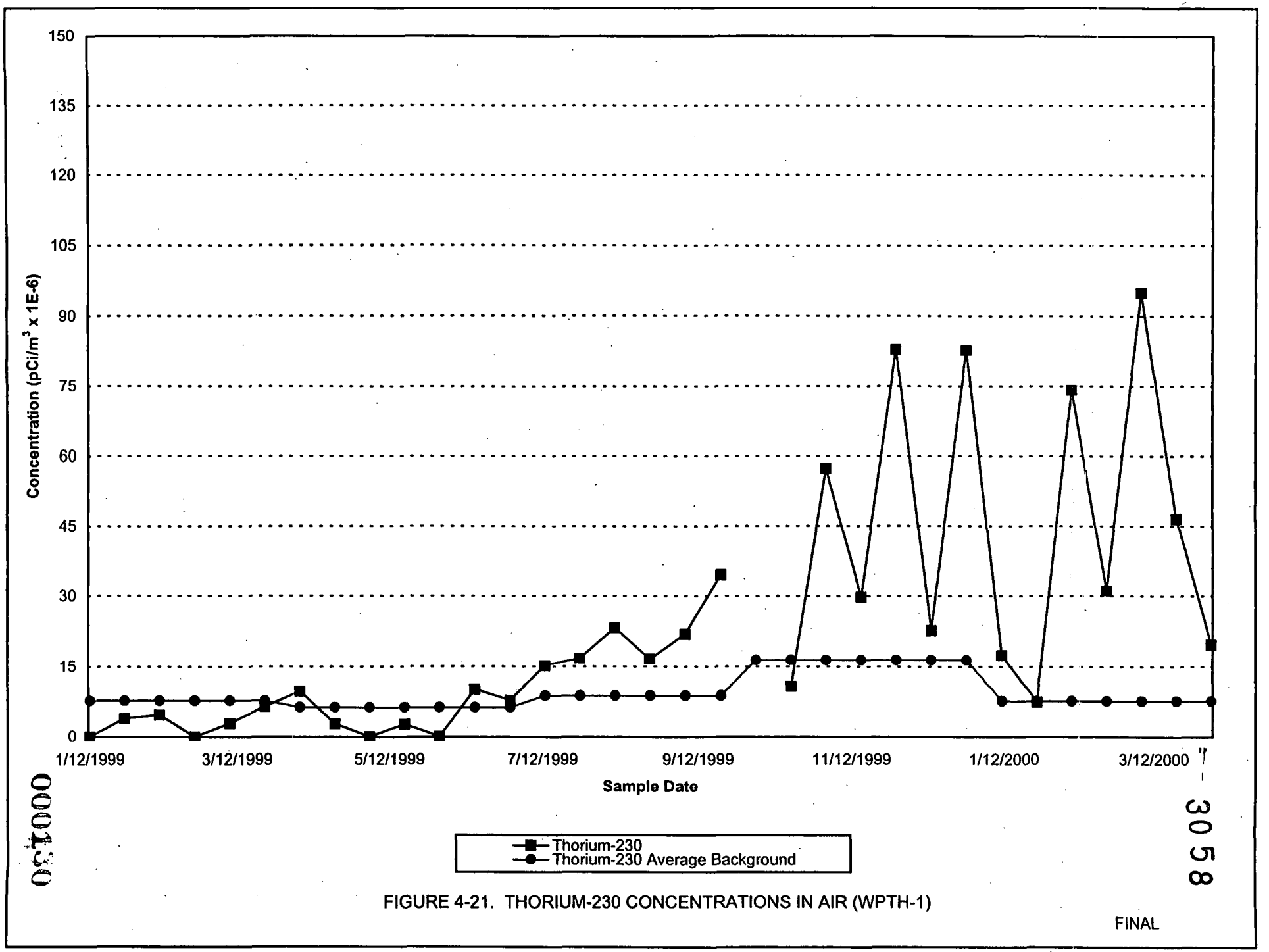

FIGURE 4-21. THORIUM-230 CONCENTRATIONS IN AIR (WPTH-1)

FINAL

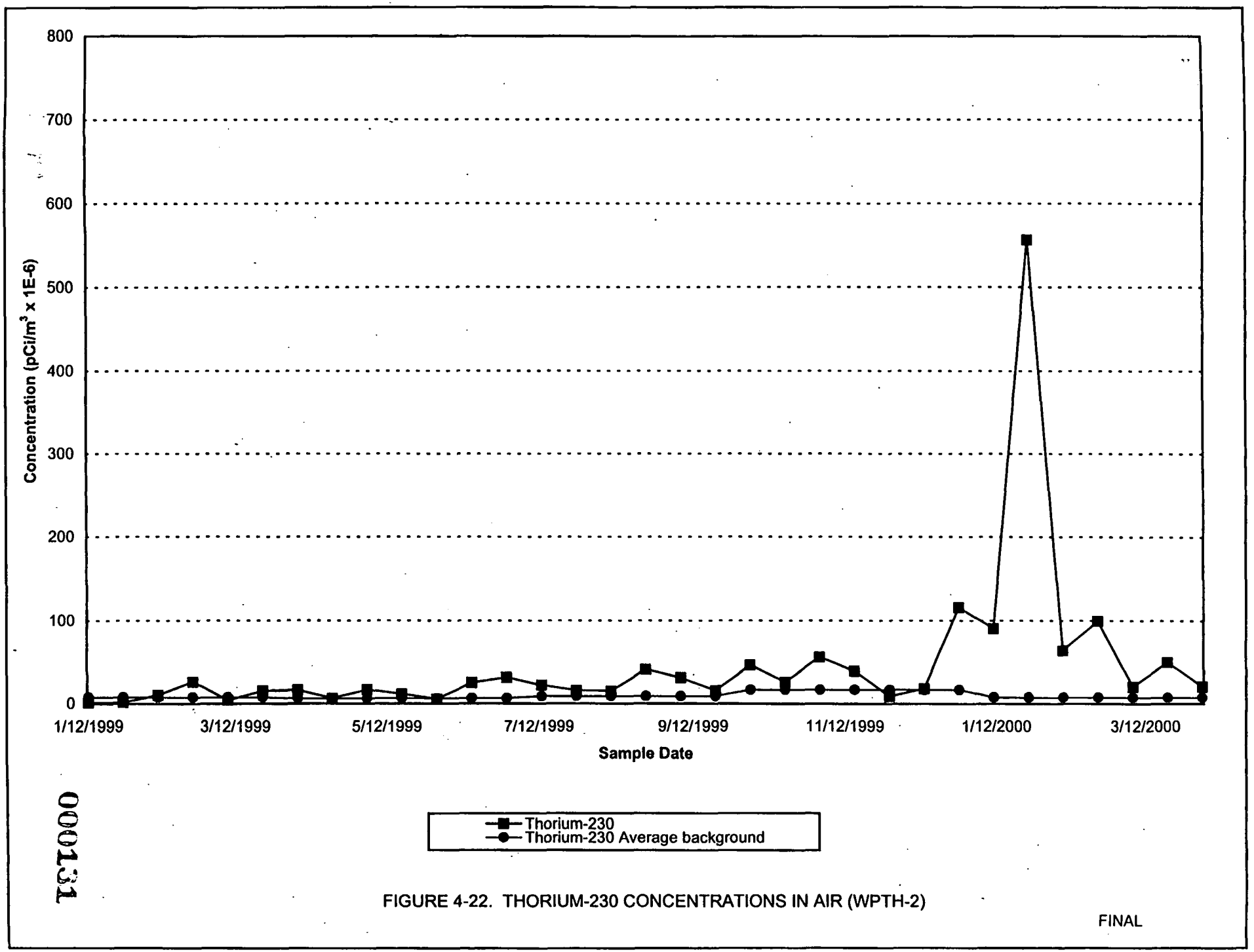

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FIGURE 4-22. THORIUM-230 CONCENTRATIONS IN AIR (WPTH-2)

FINAL

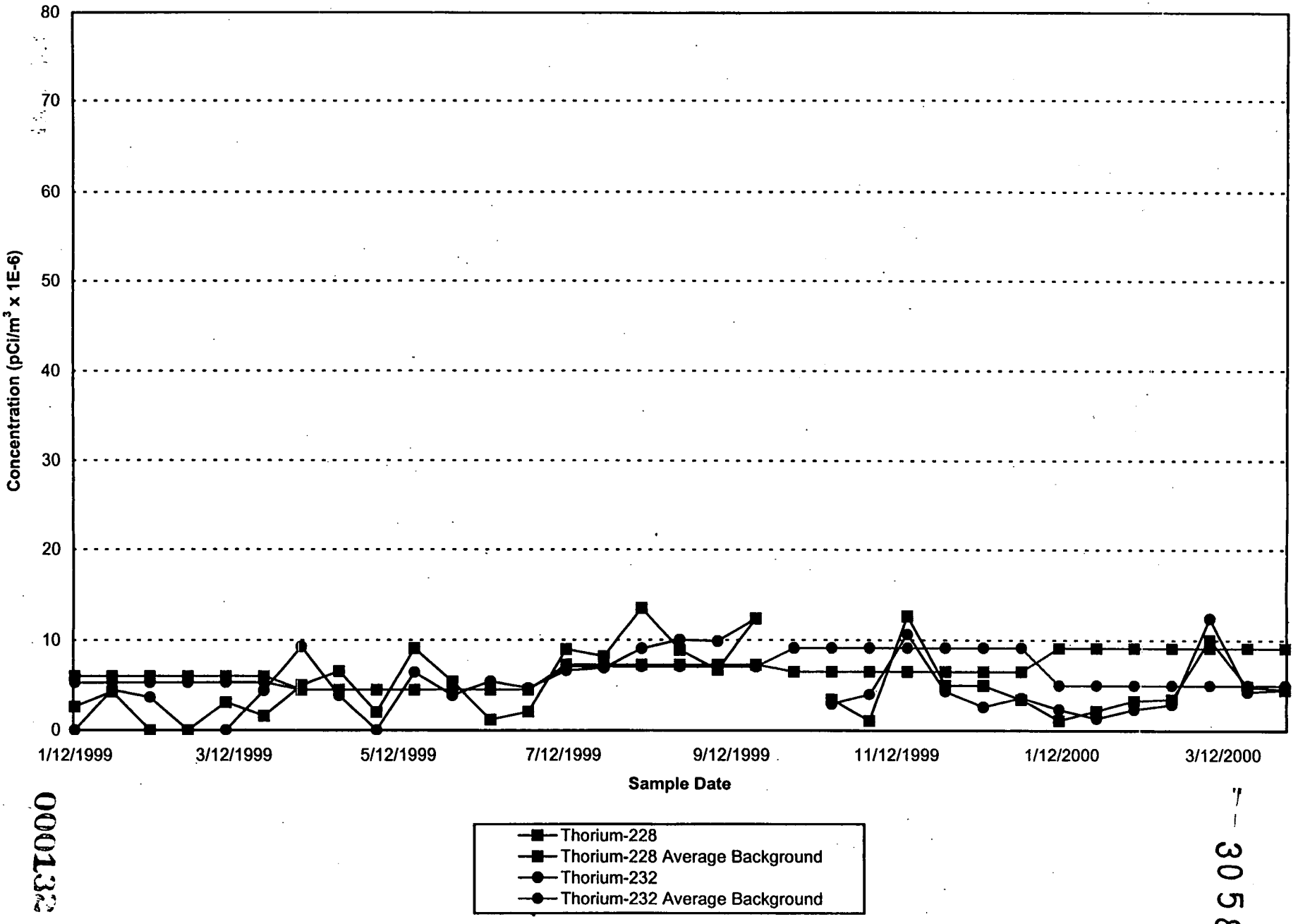


FIGURE 4-23. THORIUM-228 AND THORIUM-232 CONCENTRATIONS IN AIR (WPTH-1)

FINAL

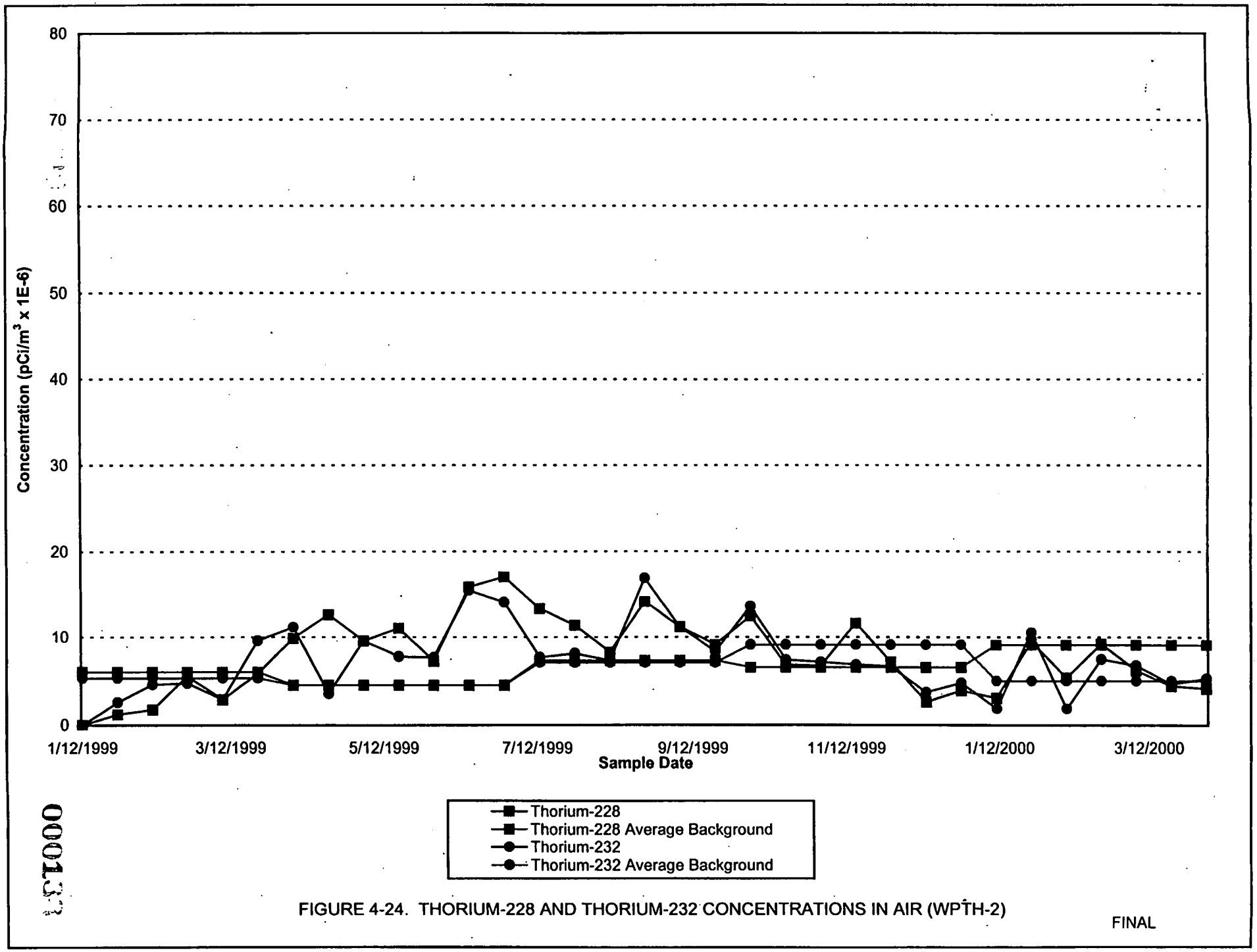
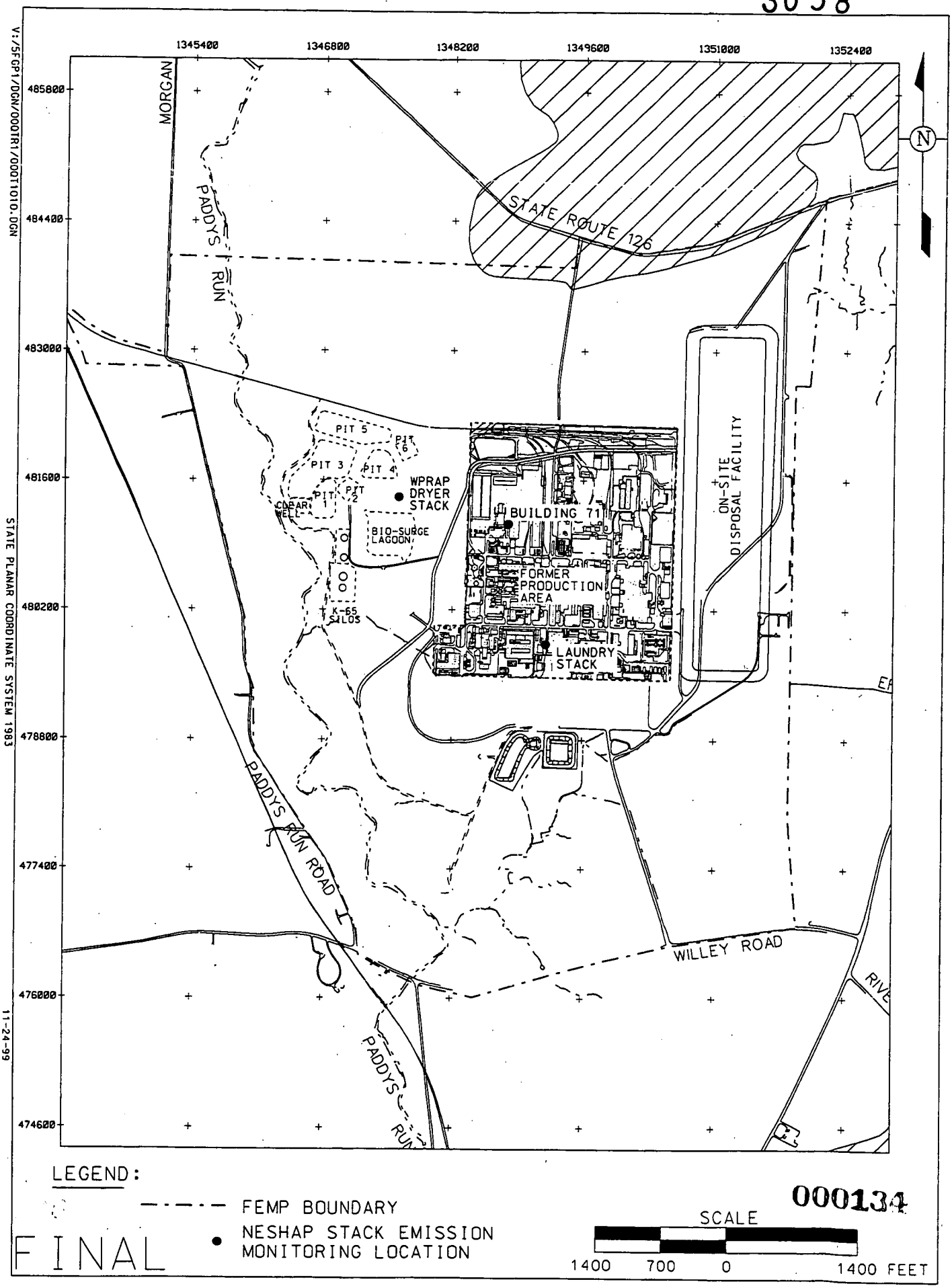


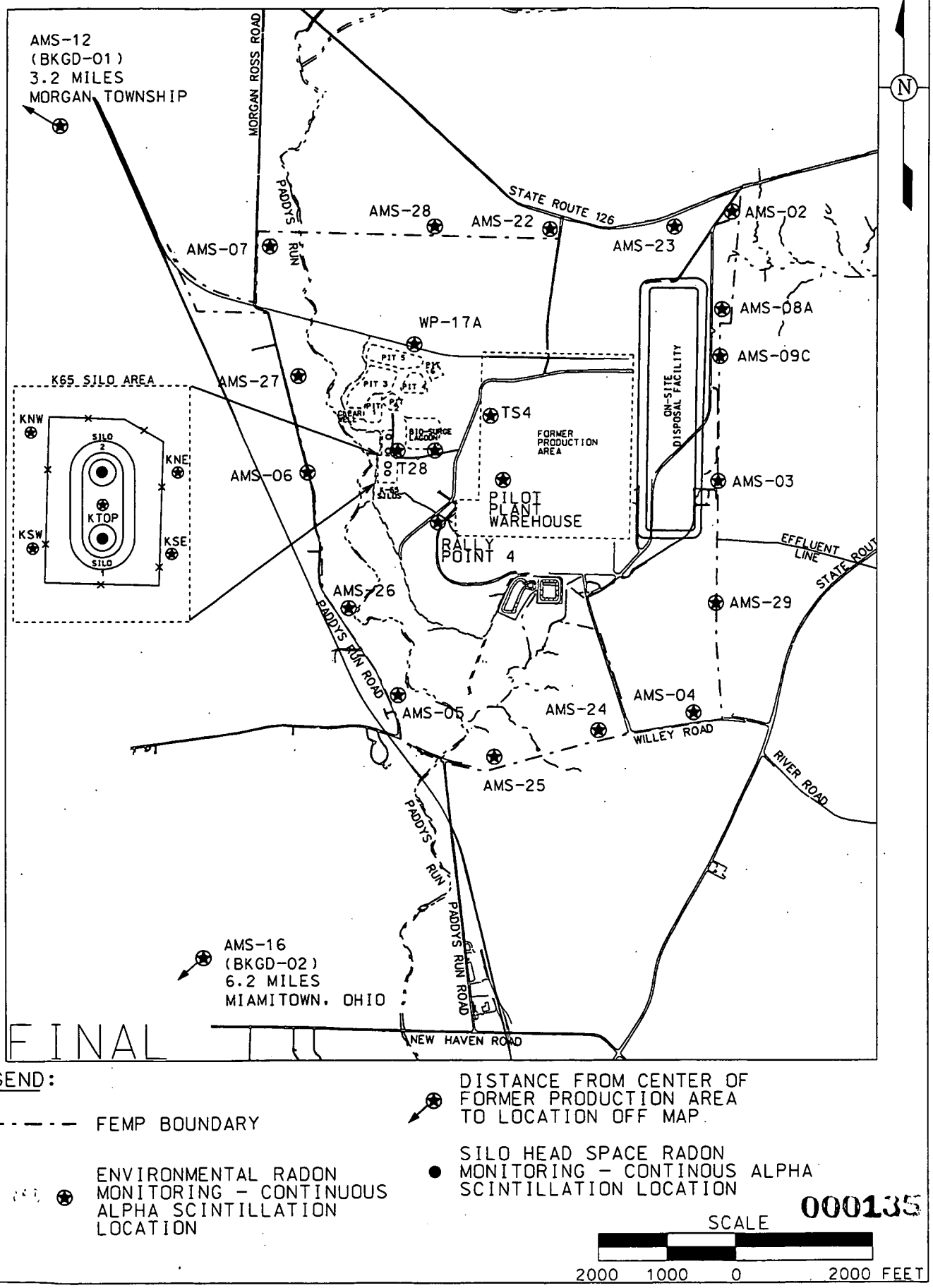
FIGURE 4-24. THORIUM-228 AND THORIUM-232 CONCENTRATIONS IN AIR (WPTH-2)

FINAL



000134

FIGURE 4-25. NESHAP STACK EMISSION MONITORING LOCATIONS



LEGEND:

- FEMP BOUNDARY
- ENVIRONMENTAL RADON MONITORING - CONTINUOUS ALPHA SCINTILLATION LOCATION
- DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO LOCATION OFF MAP
- SILO HEAD SPACE RADON MONITORING - CONTINOUS ALPHA SCINTILLATION LOCATION

000135

SCALE

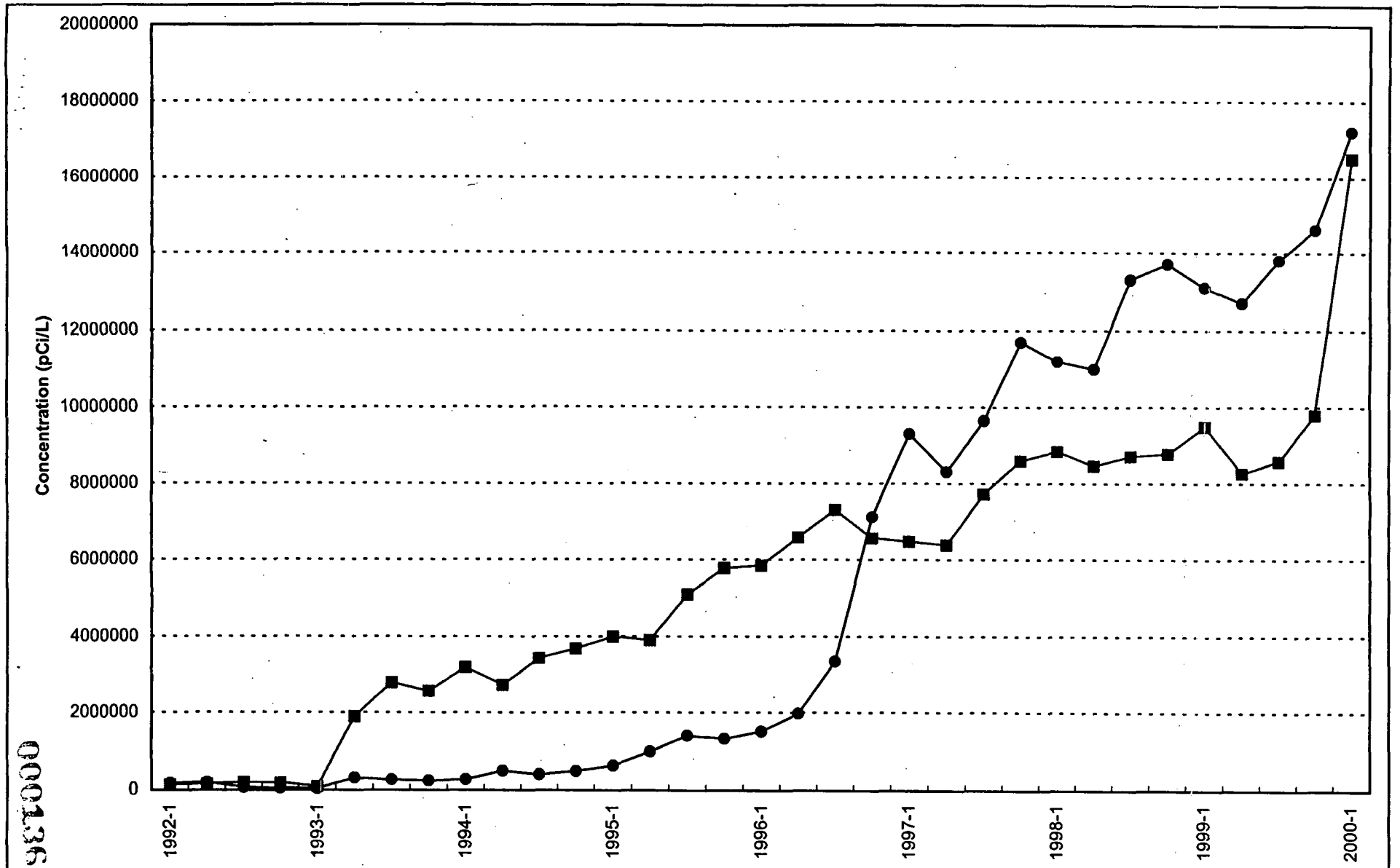
2000 1000 0 2000 FEET

FIGURE 4-26. RADON MONITORING - CONTINOUS ALPHA SCINTILLATION LOCATIONS

V:/5FGP1/DGN/0001R1/0001T1009.DGN

STATE PLANAR COORDINATE SYSTEM 1983

11-24-99

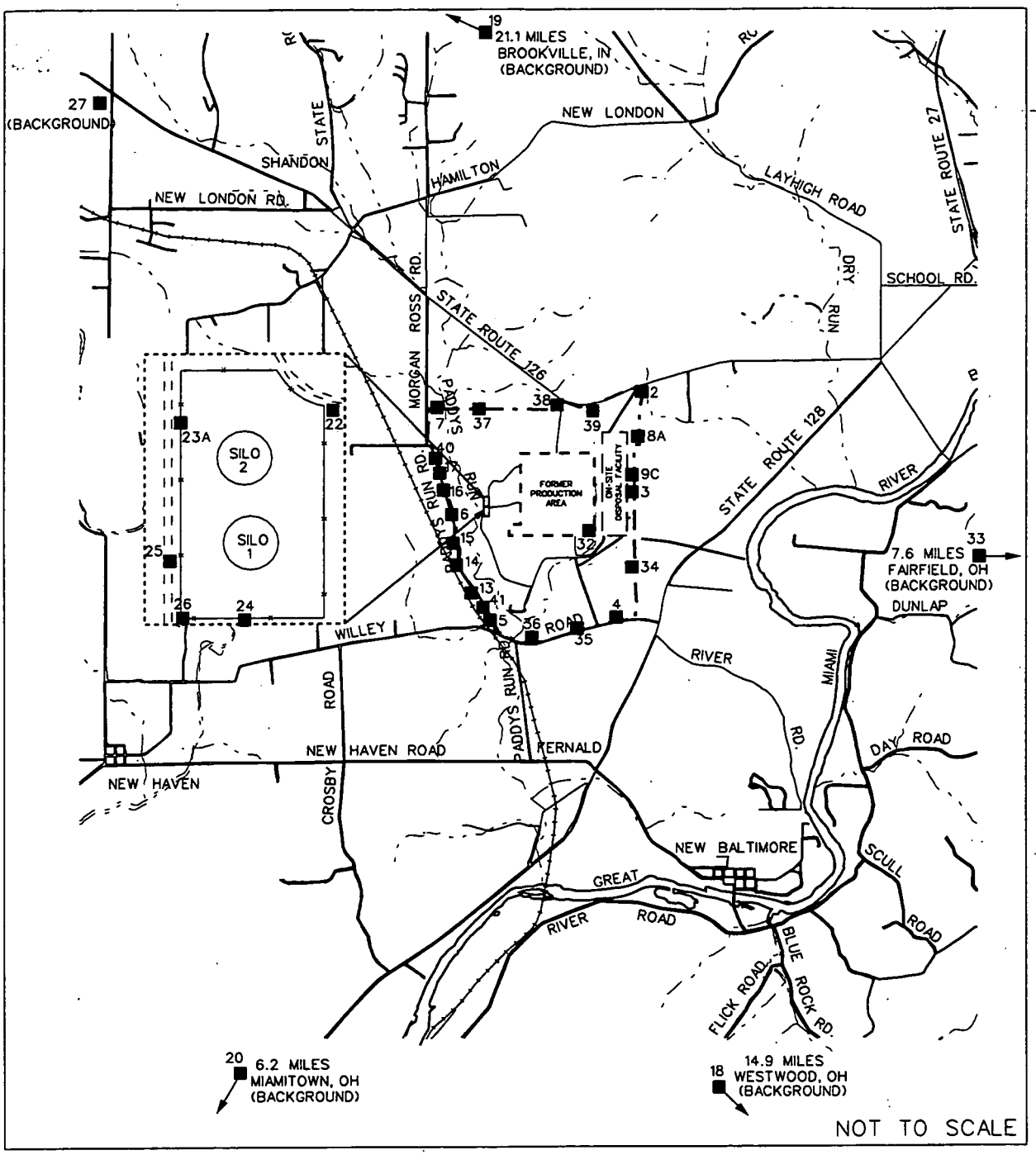


Note: 1) Defective sample line for Silo 1 was replaced during fourth quarter 1996.
2) Silo head space correction was applied beginning with the first quarter of 2000.

FIGURE 4-27. QUARTERLY K-65 SILO HEADSPACE RADON CONCENTRATIONS, 1992 - 2000

FINAL

V:\SFGPI\DGN\0001TR1\0001017.DGN



LEGEND:

- DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO SAMPLE LOCATIONS OFF MAP
- FEMP BOUNDARY
- DIRECT RADIATION (TLD) MONITORING LOCATION

11-24-99

FIGURE 4-28. DIRECT RADIATION (THERMOLUMINESCENT DOSIMETER) MONITORING LOCATIONS

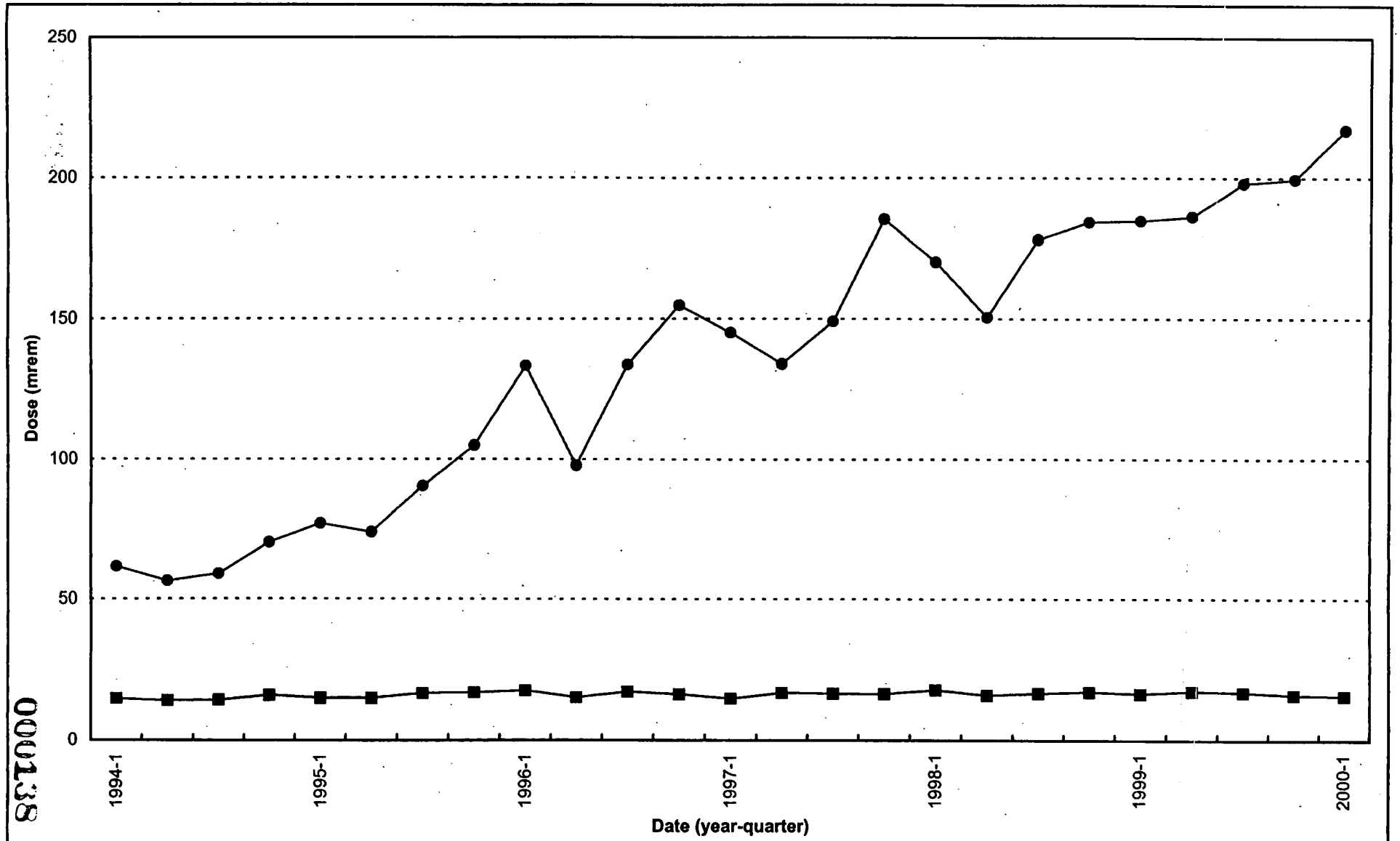
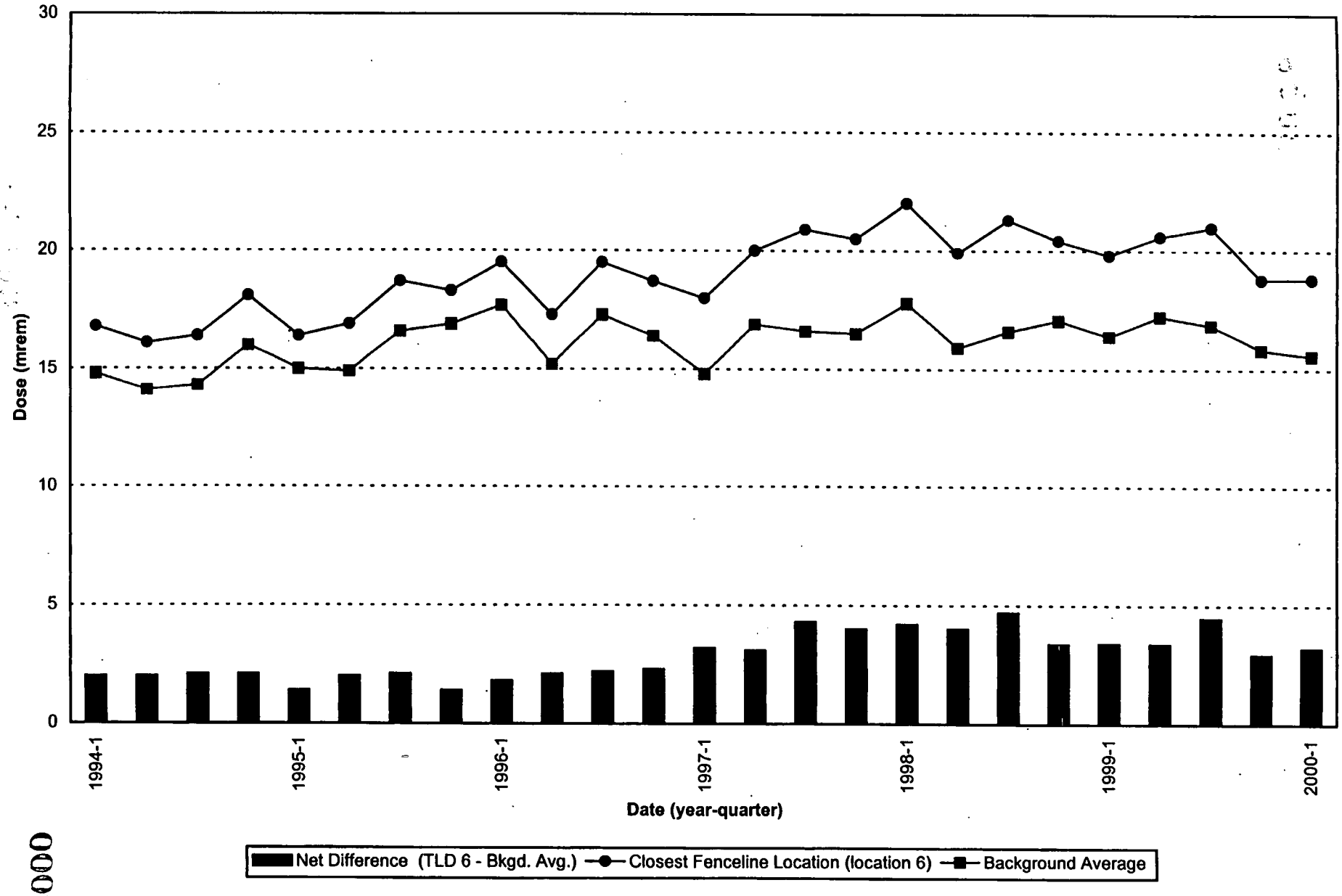


FIGURE 4-29. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994 - 2000
(K-65 SILOS FENCELINE AVERAGE VERSUS BACKGROUND AVERAGE)

FINAL



000139

FIGURE 4-30. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994 - 2000
(LOCATION 6 VERSUS BACKGROUND AVERAGE)

FINAL

Natural Resources

3058

5.0 NATURAL RESOURCES

This section provides a summary of newly impacted or ecologically restored areas, as well as a status of wetlands and endangered species at the Fernald site.

During the first quarter of 2000, there were no habitat impacts due to limited field activities during the winter months. The construction and spring planting phases of the Area 8, Phase II Ecological Restoration Project were initiated late in the first quarter of 2000. This project will be discussed in the next quarterly status report once it is completed.

Monitoring of the Area I, Phase 1 Wetland Mitigation project was initiated in the first quarter of 2000. Pond and sub-surface water levels were determined in each of the basins that comprise the wetland ecosystem. Water quality samples were also collected and analyzed for pH, dissolved oxygen, conductivity, temperature, turbidity, odor, and color. This initial data set will be used to establish a baseline from which future data can be compared. By looking at these parameters over time, the health of the wetland system can be assessed. Results from the initial sampling effort show that the wetland is healthy and progressing as planned. Water levels will be measured monthly throughout the growing season, and water quality sampling will be conducted every other month. Finally, wildlife observations will also be recorded each month.

There were no unexpected conditions observed in Paddys Run during Sloan's crayfish monitoring in the first quarter of 2000. On March 16, the Ohio Environmental Protection Agency (OEPA) was notified of increased turbidity observed in the northern drainage ditch following 1.15 inches of precipitation. Because the turbid conditions were also present in Paddys Run upstream of the northern drainage ditch, this situation was not considered to adversely impact the Sloan's crayfish population downstream in Paddys Run. Although this was the case, an investigation was conducted to identify the cause of the increased turbidity in the northern drainage ditch. The investigation revealed that the rail yard sedimentation basin appears to be the cause; however, the specific reason for increased turbidity in the basin could not be determined. Investigations into this situation continued into the second quarter of 2000, and possible corrective actions are being evaluated. This issue will be further discussed in the next quarterly status report. The U.S. Department of Energy will continue to monitor the northern drainage ditch following rain events and notify OEPA immediately of any turbid conditions.

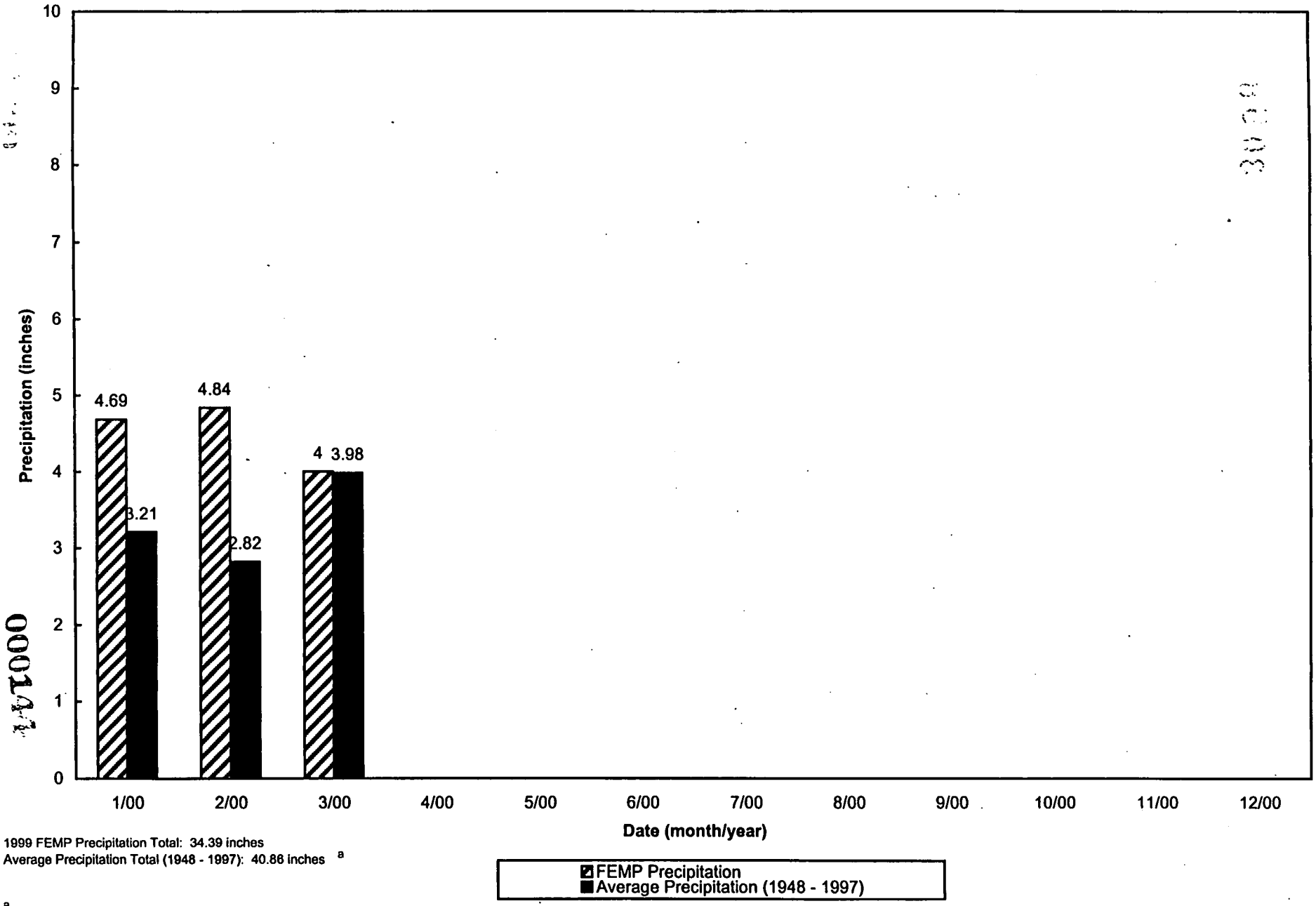
3058

Meteorological

000142

6.1 MONTHLY PRECIPITATION

This section provides the first quarter 2000 monitoring activities for the Integrated Environmental Monitoring Plan (IEMP) meteorological monitoring program. Figure 6-1 shows 2000 precipitation by month in the Fernald area compared to average precipitation by month from 1948 through 1997, based on data collected at the Greater Cincinnati/Northern Kentucky International Airport and at the Fernald site. Precipitation during the first quarter of 2000 was 13.53 inches, which is somewhat higher than the average 10.01 inches for this time period.



1999 FEMP Precipitation Total: 34.39 inches
Average Precipitation Total (1948 - 1997): 40.86 inches [a]

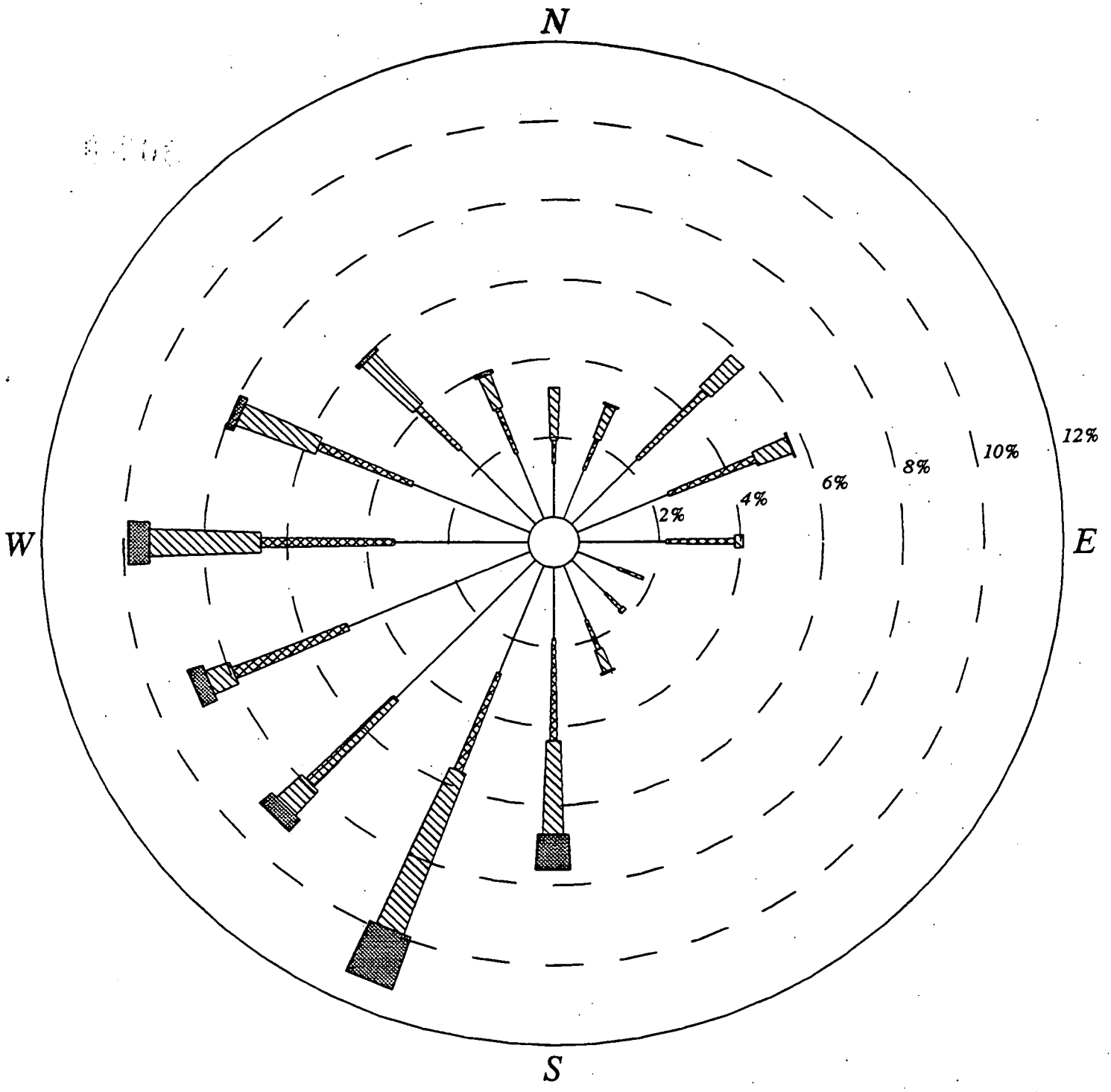
[a] Precipitation averages prior to 1993 are from the Greater Cincinnati/Northern Kentucky International Airport and averages after 1993 are from the FEMP.

FIGURE 6-1. 2000 FEMP MONTHLY PRECIPITATION DATA

FINAL

6.2 WIND ROSE

This section provides the first quarter 2000 monitoring activities for the IEMP meteorological monitoring program. The first quarter 2000 wind rose (Figure 6-2) indicates that the predominant wind directions were from the west and southwest quadrants. The wind rose indicates that airborne emissions from site remediation activities would be carried towards air monitors along the northern and eastern fenceline of the site. The first quarter wind rose is generally consistent with annual wind rose data for the Fernald area, indicating that the prevailing wind directions are from the southwest, which includes the south-southwest, southwest, and west-southwest sectors.



CALM WINDS 6.63%

WIND SPEED (KNOTS)

NOTE: Frequencies indicate direction from which the wind is blowing.

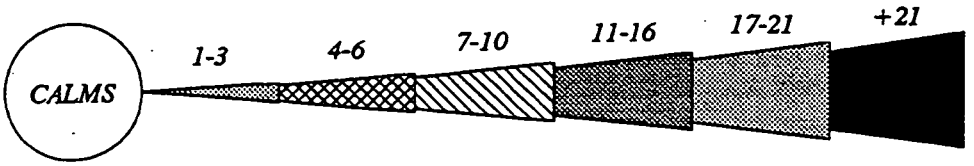


FIGURE 6-2. FIRST QUARTER 2000 WIND ROSE DATA, 10 METER HEIGHT

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